The Signal and the Noise: Why Most Predictions Fail but Some Don't Study Guide

The Signal and the Noise: Why Most Predictions Fail but Some Don't by Nate Silver

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Plot Summary

"The Signal and the Noise" by Nate Silver is a detailed examination and honest assessment of the world of forecasting and predictions. Although we become accustomed to predictions and take them for granted, the ordinary person gives them little thought although they can greatly impact their lives. This is especially true when bad data leads to even worse predictions. Financial forecasting which is risky because of the volatile and dynamic nature of economics led to some bad decisions and behavior which eventually resulted in the Great Recession of 2007, the worst economic downturn since the Great Depression. We take for granted the forecasts about temperature and rain and snow and don't realize the effort and data that goes into the prediction models and are unaware how weather forecasting has been developed and honed over the years to become one of the most successful forecasting methodologies of all time.

Silver describes how he was bored with his first job as an economic consultant when he first got out of college and became intrigued with poker. This interest led to a near-addiction to on-line gambling. He quit his job and used his knowledge of statistics to predict winning and losing hands, and how his opponents were likely to play out their hands. He was very successful and earned over $100,000 for each of the two years he was a full time poker player. However, when the U.S. government added more restrictions and scared off everyone except the expert players, Silver began to lose and eventually decided he could do more with his mathematical and statistical abilities.

Silver developed a way to predict the performance of baseball players which earned the attention of scouting organizations and Major League Baseball. When he realized that human scouts were besting him on some of his forecasts he decided that he needed to move on. After watching political pundits on cable news shows, he observed that they seemed to be wrong more than they were right. Silver figured he could use statistics to do a better job than the pundits and created the FiveThirtyEight blog which was first featured on the Internet on the Daily Kos. He eventually launched his own website which was ultimately picked up by the New York Times. Although he provided forecasts on a variety of subjects, his main focus was on the world of politics. He was extremely accurate in his predictions and drew a large audience because he accompanied his forecasts with detailed and intellectual explanations of his theories and methodology.

In "The Signal and the Noise" Silver provides great detail on forecasting methods by pioneers and innovators such as English minister Thomas Bayes and statistician Ronald Aylmer Fisher and tells the pros and cons of each. He also provides the history and performance of forecasting models for economics, weather, earthquakes, baseball, politics, climate change and terrorism. Silver cautions against forecasters being overconfident in their forecasts, ignoring context and not properly weighing uncertainty. Most of all he advises anyone who wants to have a successful career in the world of predictions to ignore the noise and look for the signal.

Chapter 1: A Catastrophic Failure of Prediction

Chapter 1: A Catastrophic Failure of Prediction Summary and Analysis

In the fall of 2008, the stock market was crashing, formerly esteemed companies were failing, credit markets were not functioning, houses in Las Vegas lost 40 percent of the their value, unemployment was soaring, billions had been committed to saving the financial institutions and the government had lost credibility with the people. All this and a presidential election was just two weeks away.

Financial institutions, credit rating agencies and the government had failed but what was also to blame were failures in predictions. It is a natural thing for people to focus on what they want to hear and want to be true. We sometimes ignore unpleasant realities to our great peril. One of the causes of the economic collapse was that the top credit rating agencies had given AAA ratings to thousands of mortgage-backed securities, financial instruments that allowed investors to bet on the failures of others.

These ratings gave a false impression by predicting success. When Standard and Poor's rated a complex type of security, the collateralized debt obligation or CDO with a AAA rating, the actual default rates for CDOs were over 200 times higher than S&P had predicted. The predictions by credit markets were relied upon to be solid predictors of economic outcomes. The failure of the CDOs translated to trillions of dollars in investments that were rated as safe when they were almost totally unsafe. There was no history for CDO activity so the agencies erroneously based their predictions on faulty statistical models but didn't admit their mistakes; they blamed it on the housing bubble. The ratings agencies claimed that no one else saw it coming either. But that wasn't true. Leading economists warned about the coming crashes for years and the ratings agencies should have paid attention.

There are mixed opinions on whether these prediction failures resulted from greed or ignorance. Economist Jules Kroll felt that the agencies failed because of their lack of "surveillance," meaning they failed to keep their investors informed about what they were actually observing. The increasing amount of defaults over the months were red flags that things were going south. These rating agencies were on the frontline in detecting problems in the housing market yet they ignored it probably because they didn't "want the music to stop." (24)

The credit rating bureaus were trusted because of their select and elite status with the government. There was self-interest among the rating agencies because they were paid well to rate a CDO each time a new one was created which was quite frequently. The rating agencies in some cases supplied their forecasting software to financial institutions which allowed them to see how far they could go in adding bad debt without falling off

the cliff. S&P also made the wrong assessment that a housing downturn would not be devastating.

To understand what went wrong, one has to first understand what the CDO is. The CDO is a collection of mortgage debt. Some of these collections are considered safe and some are considered risky. Why would anyone invest in a risky CDO? The answer is because they were cheaper. The agencies made assumptions about risk and uncertainty in their predictions for the success/failure of the CDO ratings and presented false impressions to investors.

The story of the failure of prediction is a three act story. Act I was the housing bubble. It is conventional wisdom that buying a house is the wisest investment that the ordinary person can make. But that is a false premise. After adjusting for inflation, the rate of return of buying a house has been shown to be less than that of the stock market investments. However, investing in a house had always been considered safe. What escalated the housing bubble were the speculators who flipped houses for quick profit. The fact that mortgages were easier to obtain also helped to expand the bubble. History demonstrates that economic busts often follow housing bubbles. Surveys after the fact also showed that home buyers were naÃ¯ve about what their investment actually meant for them. By 2007, home prices began to decline and requests for housing permits to build new houses plummeted.

Act II was the fact that economists missed the impact that the housing bubble would have on the average person. By 2008, housing prices had declined further. Homeowners weren't saving money but using the "equity" (that wasn't really there) in their housings as an ATM. When the housing bubble wiped the value of their houses away, they had nothing. The loss of home values resulted in a huge drop in consumer spending and confidence. While this was occurring on Main Street, Wall Street was betting $50 on every $1 a homeowner spent in the housing market. These market-backed securities amounted to $80 trillion. This practice was referred to as "leverage."

Lehman Brothers, in 2007, had a leverage ratio of 33 to 1 which meant that it had $1 in capital for every $33 in financial investments it held which spelled disaster if there was a decline in its financial portfolio. Other banks and financial institutions had similar disparities between their real value to investment ratios. Lehman stood out, however, for their appetite for mortgage-backed securities which made them particularly vulnerable when the ceiling fell out.

The impact of the failure of Lehman Brothers was deep and wide and infected other financial institutions due to its inability to repay its investors. Because of the impact that such a failure can have on the overall economy such a crisis often compels the government to bail out large faltering financial institutions. However, the government chose not to bail out Lehman while it did save Bear Stearns and AIG because Lehman was so highly leveraged and so obviously irresponsible. The crisis nearly destroyed the economy and left deep scars. Larry Summers, who was the director of the National Economic Council during this time period, summed it up by saying that before the

bubble burst, there was too much greed and too little fear and after the downturn, there was too much fear and too little greed.

In Act III, everyone tried to figure out the mess - who owed what and to whom. Economists Carmen Reinhart and Kenneth Rogoff wrote in their book, "The Time Is Different - Eight Centuries of Financial Folly," that high unemployment that lasts for four to six years often follows financial crises. The economic stimulus created by President Barack Obama in 2009 proved to be too small to impact unemployment; in fact, unemployment increased after the stimulus.

The false confidence that the country had prior to the collapse was due to several factors: there had never before been a significant decline in housing prices; rating agencies had always performed competently in the past; a housing downturn had never severely impacted the economy; and, recent recessions told policy makers that a rebound would be quick. The technical term for these prediction failures was "out of sample." In other words, there had never before been a financial crisis in the US of the magnitude and nature of that of 2007. It was all new territory and the predictors didn't have historical data to assist them with their forecasts. However, the rating agencies could have looked at the crises of other countries such as the recent one in Japan for guidance. Agencies and policy makers didn't take unknowns into account and made the assumption that if they were making miscalculations that they would just be on the margins. Generally speaking, financial predictions failed due to over-confidence.

Chapter 2: Are You Smarter than A Television Pundit?

Chapter 2: Are You Smarter than A Television Pundit? Summary and Analysis

Nate Silver did an analysis of the predictions made by political analysts on the TV program, "The McLaughlin Group," and found that they were wrong as much as they were right on the nearly 1,000 predictions analyzed. But political scientists aren't much more reliable than political pundits. Political scientists failed to predict the fall of the Soviet empire in 1988 when all the signs were there. Philip Tetlock, professor of psychology and political science at the University of California at Berkeley, found that there were two main causes for the collapse of the Soviet Union that had to be considered together in order to clearly see the impending demise of the USSR. One of these concepts was held by liberal analysts and the other by conservative analysts. Analysts on opposing sides of he political spectrum refused to embrace each other's theories and therefore the impending demise of the USSR was missed.

In further research, Tetlock concluded that the predictions of political scientists had fared barely better than random chance. He also found that personality types are reliable predictors of forecasting ability. "Hedgehogs" or type A personalities believe in big, bold ideas. "Foxes" believe in small ideas and in taking a multifaceted approach to problems. Tetlock found that the "foxes" are more successful in their predictions while hedgehogs make better television guests because they are bold in their predictions and more entertaining - picture Dick Morris and his many failed predictions made on Fox News. Foxes are not as entertaining because they appear less confident and their predictions are nuanced. Foxes are more likely to ignore the "noise" and and not chase false signals. The reason that political predictions aren't reliable is because they are often biased and partisan. Foxes of either side of the political spectrum are less likely to be as biased as their hedgehog counterparts.

Silver first had the idea of his FiveThirtyEight Blog in early 2008 thinking that it would be interesting to forecast the chances of both Hillary Clinton and Barack Obama against John McCain. Silver's main source of income had been on-line poker but that was being banned and he had to find another way to earn money. He thought that political coverage was lacking after watching cable news. The bar was low so Silver thought he could do better. At that time all the pundits were certain that Hillary Clinton would be the candidate. He began blogging on the Daily Kos where his articles gained attention.

Silver launched his FiveThirtyEight blog on his own website and made predictions about the general election. Silver provided a range of possibilities and probabilities in his predictions which is referred to as probabilistic forecasting. Silver took into account all polls, rated their reliability and applied the appropriate weighting. He also considered other relevant data including economic and demographic. After running his numbers,

Silver assigned a percentage to the chance a candidate had to win a race. But a high percentage doesn't guarantee a win. In 2011, the Boston Red Sox failed to make the playoffs even though they had a 99.7 percent chance at one point during the season to make it. Recognizing uncertainty in a prediction is not hedging your bets or creating an excuse in case you're wrong, it's just being realistic. A good prediction model will be right most of the time.

Predictions for primaries may have wide swings; however, forecasts for the general election are more reliable because there is more stability. The news media has a vested interest in focusing on outlier polls because they make the race seem closer and thus keeps up viewer interest and their ratings. Aggregate forecasts are more reliable than single polls. For obvious reasons, predictions should not be based on "magic-bullet forecasts" like the forecast by Douglas Hibbs for the 2000 election who claimed good results by basing his predictions on economic growth, which makes sense, and the number of military casualties, which makes no sense. Using this method, he predicted a landslide victory for Al Gore.

Hedgehogs often take any piece of data and manipulate it to support their biases. The Cook Political Report headed by Charlie Cook has a long record of prediction success. They focus on house, senate and gubernatorial races. Cook not only takes polls, he analyzes demographics and past election trends. Other factors are also considered: how good a speaker the candidate is and what types of ads he is running. Cook has a remarkable record on the races that are the most difficult to predict. Cook and his team conduct personal interviews with candidates in an attempt to glean more information from them. In one interview, Cook analyst David Wasserman detected that a candidate was feigning personal information about his district. Based on that observation, Cook predicted the candidate's loss and were proven to be correct on election day.

It isn't easy to be objective. Everyone has biases and preconceived notions about people and events. But using a method which incorporates quantitative variables like polls while considering qualitative elements can prove successful. A good forecaster will be alert to changes and be ready to update his predictions. Knowing one's limits and recognizing uncertainties can lead to more accurate predictions.

Chapter 3: All I Care About Is W's and L's

Chapter 3: All I Care About Is W's and L's Summary and Analysis

Silver created PECOTA which was a projection system that he developed for the Baseball Prospectus organization. Silver's system had predicted stardom for Boston Red Sox player Dustin Pedroia, a rookie that no one other analysts or experts considered a future star. In his second season he was the American League's MVP and made the All-Star team. Silver learned that what made Pedroia standout was his attitude - he didn't care what other people thought of him. All he cared about was W's and L's.

After graduating from College, Silver worked for KPMG in Chicago. He was bored and had a lot of time on his hands which he used to develop the PECOTA system. Baseball Prospectus predictions on how each baseball player would perform considered three elements. First, they had to understand the context of the player's stats. It was important to know how the player played at home as opposed to away. Secondly, they had to separate skill from luck by using a well-designed forecasting system that identified statistics that were susceptible to luck. Lastly, the system had to recognize changes in performance due to aging. Bill James of the Prospectus had determined that baseball players peak in their late twenties.

Silver found James' aging curve too smooth. He thought there was more noise and more variables than represented in his aging curve. Gary Huckaby, founder of the Prospectus, reasoned that players in different positions had different aging curves - the shortstop position was more physically demanding that other positions. Players who were just naturally more athletic could be expected to have longer careers. In all, Huckaby theorized that there were twenty-six distinct aging curves that represented different types of players. But neither system produced accurate performance predictions. Silver borrowed from each system to develop the PECOTA system.

Starting on an Excel spreadsheet, Silver developed a database that contained some 10,000 player-seasons which reached back to World War II. He incorporated an algorithm into the system in order to compare players to one another, technically known as a nearest neighbor analysis. He also included the players' heights and weights. He emulated Huckaby's aging arc except he didn't force a player into a pre-set curve. His goal was to provide a range of possible outcomes for each player. The book "Moneyball" by Michael Lewis was on the surface a story about a rivalry between statheads and scouts. The source of the animosity was that the scouts felt threatened by the nerds who were pitching the forecasting models to baseball owners. Since "Moneyball" was first written ten years ago, recognition has grown for the value of statistics, although most clubs have a nuanced approach and don't rely solely upon stats to rate their players and potential players.

Originally, Silver used PECOTA to rate the performance of pitchers. Silver pitched PECOTA to Huckaby who purchased it on the condition that Silver develop a similar system for hitters. Between the years of 2003 and 2008, the system was more accurate than other systems. It predicted only 72 wins for the Chicago White Sox in 2007 which everyone scoffed at. Their record was 72W and 90L that year. However, in 2011, Silver compared the overall success of his system with that of scouting reports in "Baseball America." The latter system had more successful predictions than PECOTA. But baseball saw the value of statistics and today scouts use a hybrid approach.

Statistics have been part of baseball since its beginning. The first "stats" were published in a newspaper in 1859 which was twelve years before the establishment of professional baseball. The Moneyball-era debates about statistics were largely over which statistics should be used. Predictions for players in advanced minor league levels has proven to be more accurate than predictions for players in the majors. Traditionally, the alternative to statistics are referred to as the Five Tools: "hitting for power, hitting for average, speed, arm strength, and defensive range." (96) The problem with the Five Tools is that it gives the false impression that all elements have the same degree of importance.

Baseball scout and former player John Sanders focuses on the mental aspect of a player, his game readiness. He believes that a player should have five tools in his mental tool box: Preparedness and work ethic; concentration and focus; competitiveness and self-confidence; stress management and humility; and, adaptiveness and learning ability. Some of the elements are important to forecasters. Billy Beane the protagonist in "Moneyball" considers data gathering as the key to successful scouting. To Beane, a good scout learns things about the player that no one else knows. He gets to know the kid and his family. Beane has learned to ignore most of his gut-feelings because they can lead him astray.

The key to good forecasting is not limiting your model to quantitative information. It's a positive to learn the proper weighing of the information received. A good forecaster considers a lot of information but also winnows it down with good analysis. A recent variable that can be included in rating a baseball pitcher is the pitch f/x which is a camera that measures the speed and movement of a pitch as it is delivered to the plate. The fear that scouts had about statistics was baseless. They were not replaced by computers. Major League Baseball uses everything at their disposal, including stats, when making drafting and trading decisions.

Good predictions are based on big and small information. The key for the forecaster is to develop good tools and habits so that he seeks out the best information and knows where to find it. PECOTA was the last forecasting system to be created for baseball but Silver is sure that someone will one day develop a new improved system.

Chapter 4: For years You've Been Telling Us that Rain Is Green

Chapter 4: For years You've Been Telling Us that Rain Is Green Summary and Analysis

On August 23, 2005, several small vortices, spirals of wind rotating in a counterclockwise motion, were spotted over the Bahamas. These seemingly harmless disturbances escalated and grew into a devastating hurricane called Katrina. It first cut across Florida as a category 1 storm and grew in strength as he traveled across the Gulf of Mexico. The computer models all saw the same trajectory for the storm; it was heading directly to New Orleans. The city had always been a nightmare to weather forecasters. The city wasn't on the gulf, it actually was sunken into it. It was below sea level and both the people and the city were vulnerable to devastating harm. There were warnings to make structural changes but city officials were concerned about maintaining the famous culture of New Orleans. The National Hurricane Center forecast that New Orleans would be hit five days before it was. Not everyone listened to evacuation warnings - 1,600 people perished in the storm.

Weather forecasting is one of the success stories of this book. But as in the case of Katrina, just because we can predict the weather doesn't mean we can do anything about it. And, if people don't choose to pay attention to the forecast, what value does it have? Katrina is a story of human ingenuity and human failure.

The National Center for Atmospheric Research in Boulder, Colorado, uses the IBM Bluefire supercomputer which makes 77 trillion calculations every second. While computers have not improved earthquake or economic forecasting, they have made great progress in the field of meteorology. Statistical predictions about the weather have been available for some time. There is historical data that can be compared and averaged to make daily predictions. But meteorologists wanted more precision in their forecasts. To do so, they broke the atmosphere into a matrix.

The first attempt to predict the weather by matrices was in 1916 by Lewis Fry Richardson an English physicist. But it was well before the era of the computer and his method was clumsy and inefficient. The first computer weather forecast was made in 1950 by mathematician John von Neumann using a computer that could make 5,000 calculations per second. With the advancements in computers, weather forecasts have become more accurate. In the latest iteration of grid forecasting, the grid representing the atmosphere has been reduced in size to provide targeted forecasting.

The chaos theory was first conceptualized by MIT's Edward Lorenz in 1972 in a paper that began with the expression: "The flap of a butterfly's wings in Brazil can set off a tornado in Texas." (118) The chaos theory is applicable to systems that are both dynamic and non-linear. In essence, the chaos theory is defined by the concept that a

small change in initial conditions can produce large and unexpected divergence in outcomes. The problems usually stem from inaccurate data or erroneous assumptions about the data. Weather is a dynamic, ever-changing system and the forces that govern atmospheric movement like gas and fluids are non-linear. Which all goes to prove that weather predictions are subject to being highly inaccurate because of the system it is making forecasts about. Because of the dynamic nature of weather, the forecasts quite naturally are a combination computer forecasts and human judgment.

The forecasters at the National Weather Bureau know the flaws of their computer models and are aware of the damage that the chaos theory can bring to their forecasts. With all the advancements in computer science, in the end these forecasters trust their eyes - a visual inspection of a graphic illustrating an interaction between two variables is a more reliable way to identify outliers than using a supercomputer. This is the same concept behind "CAPTCHA" technology that uses slightly blurred and manipulated words that the human eye can decode yet will stump computers. The NWS keeps records on the successes of both computers and humans in predicting weather. These records indicate that the humans improve computerized predictions.

The most impressive advances in weather forecasting is in predicting hurricanes. Predictions of the size and destination of the hurricanes has steadily improved over the years. Dr. Bruce Rose of the Weather Channel indicated that their forecasts are oriented toward the concerns and needs of the typical person. The channel gets its basic raw data from the government. Meteorologist Allan Murphy pointed out the three elements of weather forecast quality: accuracy, honesty and economic value (did the forecast help policy makers make good decisions?) Good weather forecasts must not make assumptions that the next day will be like the previous one and it must present more than expectations based on historical averages. Computer scientist Eric Floehr did research on the accuracy of forecasts and found that the NWS was most accurate overall with AccuWeather having the best precipitation forecasts and the Weather Channel the best on temperatures. Floehr uncovered two disturbing facts in his research. Sometimes forecasts from private organizations are worse than random chance yet they continue to produce them. Sometimes numbers were flagrantly fudged.

The single most important test of a forecast is calibration which measures accuracy on a long-term basis. The NWS's forecasts are well-calibrated. The Weather Channel tends to fudge their long-term numbers. While watching local weather is usually sufficient for the general public, when volatile weather is approaching, it is best for the consumer to get their information directly from the NWS whenever possible.

The Hurricane Center does not issue policy guidance to local officials. Instead, it communicates with the National Weather Service which issues warnings and evacuation guidelines. The Hurricane Center wants only to fulfill its mission and that is to forecast hurricane activity. Evacuation warnings are not always heeded by the people or even the officials. In the case of Katrina, Mayor Nagin delayed issuing an evacuation notice by a day which caused unnecessary confusion and risk for the residents.

Chapter 5: Desperately Seeking Signal

Chapter 5: Desperately Seeking Signal Summary and Analysis

On a Sunday evening in L'Aquila, Italy, people were preparing for bed when they felt two mild tremors. The tremors were magnitude 3.9 and magnitude 3.5 earthquakes. They were small magnitude quakes but they were the seventh and eighth in a cluster measuring magnitude 3 or more in a week. Sulmona, a nearby city, had recently had an earthquake scare. A technician named Giampaolo Giuliani who worked at Italy's National Institute of Nuclear Physics, had detected high levels of radon, a possible precursor of an earthquake. He warned the mayor but later was fined for scaring the public. Although the frequency of the L'Aquila quakes was unusual, the city officials told the people they were safe. However, Monday morning a magnitude 6.3 hit L'Aquila killing more than 300 and leaving 65,000 homeless and $16 billion in damage in its wake. The city should have been more prepared since it sits on a violent type of fault known as a subduction zone. A number of L'Aquila scientists and public officials were tried for manslaughter in 2011 for not warning the public about the possibility of a large magnitude quake after the fore-shock warnings. The charge was absurd since to this day there is no proven way to predict an earthquake.

A magnitude 9.0 hit Japan in 2011. The strongest quake ever recorded was 9.5 in Chili in 1960. The main reason that the 6.3 hit L'Aquila so hard was due to the city's complacency. The officials had not taken the steps to protect its people and property. Guiliani's prediction was investigated and it was concluded that the high levels of radon and the subsequent quake was just coincidental. Susan Hough of the United States Geological Survey explained that the the area from southern China through Greece is a concentration of the world's most destructive earthquakes. Earthquakes kill more people than hurricanes perhaps because they cannot be predicted. Many kooks predict earthquakes each year. Some claimed that because toads in a pond fifty miles away from L'Aquila stopped spawning five days before the earthquake hit, that it was a predictor of the quake.

Silver predicts that a major earthquake will strike California in the next ten years and that there will be more earthquakes in Japan than in New Jersey. But predictions are different than forecasts. A prediction is a definitive statement about where and when something will happen, for example, when an earthquake will strike. A forecast is a probabilistic statement that provides the percent chance that an earthquake will strike a certain area over a certain number of years.

There are tools that will provide the long-term probability that an earthquake will strike in a certain location. The USGS forecasts that a major earthquake will hit San Francisco every thirty-five years. They have such predictions for all major US cities yet they claim that earthquakes can't be predicted. Seismologists Charles Richter (of Richter scale fame) and Beno Gutenberg discovered a relationship between the magnitude of a

quake and the frequency with which one occurs. Based on the Gutenberg-Richter theory, Susan Hough's biggest worry is that a magnitude 7 quake could hit Iran. The USGS estimates that between two and four million people could perish in such catastrophic event. The Holy Grail for all seismologists is developing a way to predict earthquakes. Even skeptical seismologists admit that there seems to be a patterning to earthquake distribution.

Aftershocks occur after a major quake and normally aren't as strong as the original quake. On rare occasions they have been recorded to be as strong or even stronger than the original quake making the seismologists wonder if the first quake was actually a fore-shock and therefore a warning of the impending earthquake. Were the multiple small quakes before the large earthquake in L'Aquila fore-shocks? It appears that half of the major quakes are preceded by discernible fore-shocks although the 2010 Haiti quake was not. In fact the last earthquake of 4 or more in Haiti was in 2005. There were clusters of fore-shocks or small earthquakes in Reno in 2008 but were not followed by a large quake.

Hough's 2009 book, "Predicting the Unpredictable: The Tumultuous Science of Earthquake Prediction" is a history of efforts to forecast earthquakes. It chronicles many attempts but shows no significcant progress or promise. Geophysicist Brian Brady, a Ph.D. from MIT, predicted a 9.2 in Lima, Peru, in 1981. The media got hold of the prediction and terrified the people. There was no quake. Russian mathematical geophysicist Vladimir Keilis-Borok claimed to have created a new and successful forecasting model but was his forecast missed when he predicted a major earthquake in the Mojave Desert in 2004. David Bowman of the Department of Geological Sciences at Cal State Fullerton created a forecasting method that could predict where earthquakes were likely to occur along a fault and where they were unlikely to occur. He had a few successes until in 2007 a magnitude 8.5 hit in an "unlikely" spot on a fault in Indonesia.

What happens in an underdeveloped theory like earthquake prediction is that people begin to mistake noise for a signal which led to false alarms and setbacks in the science. The term for mistaking noise for signal in statistics is "overfitting" which is a reference to "the way statistical models are 'fit' to match past observations." (163) There are better results when there is good deal of historical data to plot and there is an absence of forced overfitting. A model is most likely to be overfit when the data is limited and there is a lack of understanding in the basic relationship - which is the case with earthquake forecasting. Overfitting a model produces deceptive results. It looks good on paper but produces bad predictions.

Unfortunately, Japan did not prepare for an earthquake over magnitude 8.6. The nuclear plant in Fukushima was not built to withstand anything over 8.6. A nuclear emergency resulted from the 9.1 which threatened the whole region after the plant was compromised by the earthquake and subsequent tsunami. While data that Japan seismologists used indicated that large magnitude earthquakes would occur only every 13,000 years, the Gutenberg-Richter model estimated such an occurrence was likely every 300 years. Had they heeded the latter prediction, they could have been better

prepared for the 9.1. It will take many years to learn the frequency of magnitude 9 earthquakes and whether or not a quake larger than 9.5 is possible.

Recent work by Tom Jordan of the University of Southern California suggests that aftershocks sometimes travel in a predictable direction along a fault line. If this is proven to be accurate, warnings could be issued to pertinent population areas. There has also been some success in measuring fault stress. Scientists will undoubtedly continue to pursue a solution.

Chapter 6: How to Drown in Three Feet of Water

Chapter 6: How to Drown in Three Feet of Water Summary and Analysis

While political predictions are accompanied by the caveat that there is a margin of error, economic numbers are presented with more certainty. When an economic prediction is off, surprise is often expressed by experts and by the media. In actuality, there should be no surprise because historically they have not been particularly accurate. Economic forecasters even missed recessions when they were already underway. Economic forecasts don't emphasize the substantial difference between their predictions and actual outcomes.

A devastating flood hit Grand Forks, North Dakota. There was no loss of life but the river spilled more than two miles in the city and most homes were either damaged or lost. The damage of the flood could have been prevented or minimized with sandbagging and the diverting of the water into a non-populous area. The potential for the flood was known for years but no steps had been taken to prepare for it.

Economic analysts predicted a GDP of 2.4 percent in 2008. Gross Domestic Product (GDP) is a measure of the nation's economic growth. The forecasts were way off. The economy actually shrank by 3.3 percent. Two quarters of negative growth is called a recession. The actual value of the GDP was well outside economic predictions six times in eighteen years which is a dismal record. The Survey of Professional Forecasters found even worse results which indicated that the economic forecasters were wrong half the time. In the 1990s, economists predicted only two of the 60 recessions that occurred around the world.

Economists typically fail to address uncertainty in their predictions. One economist who produced honest and accurate predictions leading up to the recession was Jan Hatzius, the chief economist at Goldman Sachs. He predicted the housing bubble, homeowner defaults and the collapse of financial institutions which is exactly what happened. He also did not agree with other economists who predicted a quick recovery. Hatzius cites three causes for poor economic predictions: 1) it is difficult to determine cause and effect from stats; 2) the economy is dynamic; and, 3) the data the economists have to work with is not reliable.

So much economic data exists that it is impossible to consider all of it. Private data providers follow four million statistics and the government provides 45,000 economic indicators. Economists followed the trends of leading indicators but only two - housing and temporary hiring - led to the 2007 recession. Historically, the Leading Economic Index has declined in advance of a recession but has also given many false alarms. Following a recession, unemployment can be a lagging indicator because businesses

wait for certainty before they hire. But unemployment can slow recovery because unemployed people don't spend which is the best way to stimulate the economy. Consumer confidence is another indicator that gives mixed signals.

If a recession or slow-down is predicted, that forecast can be ameliorated by action from the Federal Reserve or the government. Government policy can change the values of variables and leading indicators over time. The biggest challenge for an economic forecaster is to contend with the ever changing domestic and global economy. Changes are required from time to time in the fundamental structure of an economy to keep up with new trends, employment concerns, financial imbalances and changing demographics. Economists have to recognize when temporary changes aren't temporary and that there is a new normal.

Economists missed predicting the 2007 recession in part because they based their forecasts on data from the Great Moderation - the years from 1983 to 2006 during a time when there were only small recessions with quick recoveries. They failed to look at other times - like the 1930s - when there were great and sustaining declines in the economy. All data that is available should be included when making a forecast. The actual GDP in 2008 could have been actually as low as -9. Had the White House known the real economics, they probably would have advocated a larger stimulus. It's difficult to know where the economy is going when you don't know where it is.

The economy is similar to the weather in that both are dynamic and ever-changing and both are subject to uncertainty. But weather forecasting is more successful because the analysts have hard science to rely upon. Economics is a much softer science where cause and effect are not clear. There are more elements in economic forecasting that are contradictory, unknown and confusing. Some economists feel that it is not necessary to understand the underlying intricacies of the economy and just rely on the results produced by their models. But that's wrong-headed thinking. Theory that backs up numbers makes the prediction stronger and more credible.

Predictions are more accurate in the aggregate rather than relying on a single forecast. On the economic front, however, the forecasts that make up the aggregate are often way off. Because of all the variables and the dynamic nature of the economy, economists have learned to use their own judgment in making adjustments. The downside of that is that human judgment can introduce personal or partisan bias into the mix. With all the advancements in computer science and forecasting models, their output can be neutralized by human biases. Robin Hanson, an economist at George Mason University, has a blog called "Overcoming Bias" and encourages his readers to try to identify which cultural factors or beliefs may keep them from making good ideas. He is also an advocate of prediction markets which is covered in a later chapter. Forecasters should not be discouraged from taking risk into account when they make predictions.

Chapter 7: Role Models

Chapter 7: Role Models Summary and Analysis

In 1976, a young soldier died from what turned out to be the H1N1 virus, aka the swine flu. When the strain first appeared early in the century it killed millions around the world. The Ford Administration overreacted to the scare and ordered two million vaccines and caused unnecessary panic. As it turned out, the virus was isolated to just a few cases, the Ford administration looked inept, the rushed vaccine that wasn't thoroughly tested caused a neurological disorder known as Guillain-Barre syndrome at a higher than average incidence and the government was sued by those stricken with the syndrome. In 2009, the H1N1 virus appeared again and once again the threat was overestimated. Nations in Southeast Asia like China and Indonesia were particularly vulnerable to the virus as well as the Mexican state of Veracruz. By the end of 2009, there were reports of some 1,900 cases of the swine flu in Mexico with 150 deaths. H1N1 appeared to be the superbug that scientists had feared. Countries warned against travel to Mexico and to Southeast Asia. There was only a small number of cases in America and most were mild. However, the World Health Organization warned of a pandemic and dire predictions about sickness and death were made - perhaps as many as 90,000 would die in the US alone.

As it turned out, the swine flu outbreak in the US had a lower than average death rate than that of a normal flu season. The predictions about the swine flu were wrong in both 1976 and 2009.

Extrapolation is a basic method of prediction but one that has resulted in some high-profile failures of prediction in population growth and disease. Epidemiologists have a challenge to predict the impact of an impending epidemic because they have to make their extrapolations from very limited data that is often considered dubious. The data that is reported when an infectious disease first strikes is often misleading. In the 2009 swine flu episode, the analysts were dealing with inaccurate data. And making matters worse, the US media was obsessed with swine flu and put undue focus on it. The high rate of the disease in Mexico was not applicable to the US because of differences in circumstance and environment. The HIV AIDS virus was initially misdiagnosed and later underestimated.

Some predictions can be self-fulfilling - like a self-fulfilling prophecy. A political poll showing one candidate far ahead of the others can sway voters over to him since everyone wants to vote for a winner. When a disease is widely discussed in the media, people begin to believe they have the symptoms. Doctors make estimates of the incidence of disease based on publicly reported cases which often misleads them. The Finnish scientist Hanna Kokko compares a prediction model to map drawing. Maps need to include relevant data of roads and towns and mountain ranges but too much detail only serves to be confusing.

The most basic mathematical approach to how an infectious disease impacts patients is the SIR model. "S" stands for being "susceptible" to a disease; "I" stands for being "infected" by it; and, "R" stands for being "recovered" from it. The goal of a vaccine in the case of an epidemic is to move patients from "S" to "R." The problem with that is that the assumption is made that everyone has the same susceptibility and recovery rates.

The most prominent cases in which flawed assumptions are used are those of sexually transmitted disease. There was a rise in unprotected sex among gay men in San Francisco in the late 1990s and early 2000s. The assumption was made by experts that there would be a new AIDS epidemic but they were wrong. Although other STDs increased in frequency, AIDS did not. It was later found to be attributed to the fact that gay men were seeking out partners who had the same HIV status as they did.

Children who contracted measles in a recent outbreak in Chicago that panicked the city and the Fort Dix soldiers who caught swine flu were probably victims of non-random mixing. The Fort Dix outbreak was probably due to the cramped conditions and close quarters in a barracks. The measles outbreak struck poor neighborhoods in which children were less likely to have vaccinations. Bottom line, assumptions about disease often provide false pictures of what is really taking place. Advancements are being made in disease prediction using a technique known as agent-based modeling. Researchers at the University of Pittsburgh are at the forefront of this technology. These models produce simulations with waves of disease rippling through zip code by zip code. Dr. Daum and his team at the University of Chicago are developing an agent-based model to study the spread of MRSA, a dangerous antibiotic resistant staph infection that causes cuts and scrapes to develop into life-threatening disease.

The agent-based models are difficult to test which is why the teams in Pittsburgh and Chicago have not yet made specific predictions with them. They are using the data to have insight into the trajectory of disease. Epidemiologists are more realistic about the limitations of prediction than analysts in other fields. Modeling tools are developed to help us understand the universe not replace it.

Chapter 8: Less and Less and Less Wrong

Chapter 8: Less and Less and Less Wrong Summary and Analysis

Haralabos "Bob" Voulgaris makes a million dollars a year betting on sports. He uses computer simulations and is genius at analyzing the data. His gambling career began in 1999 when he was a college senior. He took $80,000, his life savings at the time, and bet it on the Lakers to win the NBA championship. The Lakers weren't being picked by anyone and had had a bad year the season before. But Voulgaris had watched a lot of their games and liked what he saw. It was nip and tuck all the way, but the Lakers came out victorious and Voulgaris was half way to becoming a millionaire.

Successful gamblers and forecasters do not think in terms of no-lose bets and precise measurements. They think of probabilities. Voulgaris had thought all along that the bookies had undervalued the Lakers. After he was bankrolled, Voulgaris was able to push smaller edges, that is make small bets compared to his overall worth. He watches every NBA game and runs computerized simulations on each game that he only uses it if there are other signs that he has an edge. He even has his own scouts to chart each player's defensive positioning. He makes both point spread bets and the over-under line. He notices changes in scoring numbers and makes adjustments accordingly.

Thomas Bayes was an English minister who was born in the early 18th century. He was a Fellow of the Royal Society and served as a mediator of intellectual debates. After his death, his most famous work, "An Essay toward Solving a Problem in the Doctrine of Chances" was published. It addressed formulating probabilistic beliefs when encountering new data. In simplistic terms, when a person emerged from a dark cave and saw the sun rise for the first time, he didn't know if it was a one time event. After months and years of observing the sunrise, the probability factor that the sun would continue to rise increased to 100 percent. Probability is defined as gathering more information and getting closer and closer to the truth.

French mathematician and astronomer Pierre-Simon Laplace was an advocate of scientific determination and believed that man could predict the universe if the position of every particle were known. The intimate relationship between probability, prediction and science was understood by Bayes and Laplace. Bayes' theorem was a simple algebraic expression with three known and one unknown variables. Results from Bayes' theorem can provide great predictive insight. It is a theory that is concerned with "conditional probability." It provides the probability of the accuracy of a hypothesis IF some event occurs.

Consider the terrorist attacks of 9/11. Prior to the attack, the probability of terrorists crashing planes into the World Trade Center would have been near zero. But using

Bayes' theorem the chances of a terrorist plane striking one of the towers would have immediately increased to 38 percent after the first plane hit. Estimates are continuously updated as new data is received. Bayes' theorem forces us to think probabilistically about the universe.

According to medical researcher John P. A. Ioannidis in his influential paper, "Why Most Published Research Findings Are False," the majority of hypotheses presented as true in the medical, academic and scientific fields are false. So much data is produced now that it creates more noise than it does signals. The issue at the root of the problem of inaccurate forecasts or false positives is flawed statistical thinking.

The chief intellectual rival to Bayes was English statistician and biologist Ronald Aylmer Fisher although he was born 120 years after Bayes. Fisher is responsible for the statistical methods that are widely used today. He was not a fan of Bayes and Laplace and used the term "Bayesian" as a pejorative. He didn't agree with the "Bayesian prior variable" and developed statistical methods with a goal to rid the process of bias. This type of statistics is referred to as Fisherian or frequentism which argues that there is uncertainty in taking samples of the population rather than considering the whole population. It tries to distance itself from human error. It is not particularly objective, however, since it relies on many assumptions. This method discourages the analyst from considering the data in its underlying context.

Fisher ended his career making a grievous error of judgment. He fought to prove that there was no correlation between lung cancer and cigarette smoking. Looking back, Fisher just missed it as there was plenty of evidence supporting a connection. Why did he risk his reputation on a losing battle? He was a paid consultant of the tobacco industry and was a smoker himself. Fisher did recognize that correlation does not always imply causation but his methodology do not lead analysts to try to discern which correlations do indicate causation.

The scientific method of prediction observes a phenomenon, develops a hypothesis to explain it, makes a prediction from the hypothesis and tests the prediction. Nothing useful results when one person holds that there is no probability that something is true and another argues that there is 100 percent probability that it is true. What Bayes' theorem supports is that our beliefs should converge toward one another; that is, toward the truth. There is currently a paradigm shift in the way statistical methods are being used by scientists. Some well-respected scholars are urging that frequentism not be taught to undergraduates. There is currently more support for Bayesian statistics.

Chapter 9: Rage Against the Machines

Chapter 9: Rage Against the Machines Summary and Analysis

Edgar Allan Poe was fascinated by the Mechanical Turk that had beaten Napoleon and Benjamin Franklin at chess. Poe thought it was an elaborate hoax and that a chess master was hidden under the Turk. He wrote a paper on the implications if machines (computers) were able to mimic man and actually improve upon his abilities. Poe thought that if the Turk was a machine that it would win all games which it did not. That is flawed thinking that still exists today. But computers do make mistakes which are based on the mistakes that are made when they are being created. While computers are beneficial and are labor-saving devices, we should not expect them to think for us.

MIT's Claude Shannon, a mathematician who is considered to be the founder of information theory, created the first computer chess game. Shannon saw the game's clear goal of reaching checkmate as a test of the powers of a computer. He did not think that the computer could not be defeated but observed that the computer did have advantages over human competitors: 1) the ability to make fast calculations; 2) the inability to make errors unless errors are contained in their code; 3) the inability to be lazy or bored; 4) the inability to be overconfident. Shannon also saw as many advantages for humans: 1) human minds are flexible; 2) humans have imagination; 3) humans can reason; 4) humans can learn.

In the tradition of Bayes, prediction is basically the process of gathering information and applying it to hypotheses. Prediction is a necessary part of our world because we have uncertainty and do not fully understand the universe. Heuristics is the study of computer programming and human decision making. A heuristic approach to a problem involves using basic rules when a solution is beyond our practical abilities.

Danish chess grandmaster Bent Larsen was defeated by the computer called Deep Thought but in 1989, the top-rated chess player in the world, Garry Kasparov, defeated Deep Thought. In 1996, Kasparov was defeated in the first game of a match by Deep Blue the next iteration of computer chess champs. But Kasparov came back and won the rest of the games in the match. But the next year in a rematch, Kasparov, the most intimidating chess player in the world, was intimidated by a computer. In his first game of his six-game re-match against Deep Blue in 1997, Kasparov made three first moves that virtually took out Deep Blue's database and made the computer "think" for itself. The mid-game is the strongest part of the game for a computer. Kasparov did not delude himself that he could imagine all the possible moves and their outcomes. He looked for the best move and forecast that outcome. A grandmaster like Kasparov makes some calculations about how his opponent would respond. Players at Kasparov's level actually think about the way they think and correct themselves to achieve better balance.

Computer chess machines rely on their processing power and the most promising moves rather than calculating every possibility. Their weakness is not seeing the big picture game because they focus on tactics and not overall strategy. They are easily convinced to sacrifice a piece for a lesser opponent's piece. Humans see the game as a whole. Kasparov took advantage of the computer's "blind spots." Computers have databases for each phase of the game including the end game and have losing and winning moves in their memory. Kasparov was astounded when the computer resigned the first game. It was a blunder that computers don't make. Later, after Kasparov studied the game, he concluded that the computer had calculated all the possible moves and saw that it would lose in twenty moves and resigned instead of making all those moves. Kasparov would not defeat Deep Blue again.

In the second game, Kasparov was befuddled why Deep Blue chose a move that seemed more strategic than tactical. He remembered from the previous game that Deep Blue resigned when he had twenty moves left. Was Deep Blue calculating the next twenty moves again? This time in the forty-fifth move, Kasparov resigned seeing that he was heading to a loss. He and his assistants later confirmed that Kasparov could have played on successfully to a tie. Kasparov tried different tactics in the next three games which all wound up in draws. On the final game, Kasparov made a blunder and after only a relatively few moves into the game, Kasparov resigned and stormed out. He had never been defeated in a match before. Kasparov's uncertainty and loss of confidence helped him lose the game but what also helped was a tiny software bug.

The developers of Deep Blue corrected bugs during testing. But near the end of the testing when Deep Blue made some unusual and unexpected moves. The developers could not detect the bugs. They concluded that that computer made some calculations that were beyond a human to understand or see. It was a bug that made Deep Blue make the moves that astounded Kasparov who mistook them for strategy. The computer thus intimidated Kasparov causing him to try to second-guess the computer and not play his best game.

Computers are good at forecasting outcomes for things ruled by simple and well-defined laws like the weather or chess. But computers are not good at predicting outcomes where dynamics and uncertainty are part of the mix like earthquakes and economics. When a person does a Google search, the results are a prediction of what will be most helpful to the user. The Google team uses the queries of users to refine their predictions and their system is tweaked on a daily basis. Man is his greatest technological constraint. While computer processing power doubles every year, evolution occurs in millennial time frames. Technology is a tool to make mankind better. It should not be worshiped or feared. A computer is only as good as its creator.

Chapter 10: The Poker Bubble

Chapter 10: The Poker Bubble Summary and Analysis

The "poker boom" started in 2003 when a novice poker player with the unlikely name of Chris Moneymaker turned his $39 ticket for entering the World Series of Poker in Las Vegas into $2.5 million by winning the tournament. The ESPN series about Moneymaker's win convinced a lot of people, Nate Silver included, that poker was the answer to their dreams of fame and fortune. Silver learned a lot about chance including the role it plays in our lives and how it can create delusion. The innovation of Internet poker also fueled the fad. Silver started out slow but began to make a profit on the Internet. After he had made $15,000 in profit, he quit his job as an economic consultant. His background in statistics and his understanding of probabilistic judgments and uncertainty helped him succeed.

The core in poker playing success is called "hand reading" which is calculating what your opponents may have in their hands and how it might impact their decisions on playing it out. A good poker player's forecast about the play is probabilistic. In on-line poker, an opponent's statistics can be data-mined for insight into their style of play. The process is basically Bayesian with players updating their assessments after each bet and hand. In practice, poker players differ in how they assess the probabilities of their hands. Those who do well at poker are probably better than 99.9 percent of other people at making good probabilistic assessments when there is underlying uncertainty.

Psychology is part of a successful poker playing career. World-class player Tom Dwan appears to be a low-key person and profits from the over-confidence of his opponents. He focuses on probabilities when he plays. He works at obfuscating his play to make it unpredictable. Bluffing and aggressive play is essential for becoming successful at poker. If a player doesn't exhibit these characteristics, then his play is too predictable. Bombarding an opponent with many possibilities is the best way to upend his calculations and judgments. In 2004 and 2005, Silver made an income in the six figures from poker. He succeeded because there was a huge influx of inexperienced and poor players. Similarly, he is able to standout in political forecasting because his competition consists of pundits who are actually no competition at all.

The Pareto Principle of Prediction suggests that the worse forecasters are much worse than the best forecasters are good. In other words, average success in making predictions puts a person toward the top of the scale. Silver used the statistics on other poker players to learn their success probabilities in play. At a casino, the worse players lose money at a faster rate than the best players win it.

In 2006, the Republican Congress had been voted down and was on its way out. As a final act to appeal to its conservative base it passed a law known as the Unlawful Internet Gambling Enforcement Act. The act didn't target players, it targeted the Internet companies that handled the money transactions. The Department of Justice was

targeting Internet companies that provided online gambling to Americans. Although some companies worked around the law, the new restrictions put a damper on the entire industry. Silver moved from a site called Party Poker to PokerStars where he lost over a hundred thousand dollars. Silver concluded that the new restrictions had driven the amateur players out and he had been playing against highly skilled players. Silver quit poker all together and had time on his hands which was when he founded his FiveThirtyEight site. A short time after he quit, on Black Friday, the sites were all shut down and many of the players were not able to get their money out of the sites.

Just like in baseball, it takes years of statistics to know if a poker player is a good player. There is a luck component that is unknown and variable in both arenas. A poker player with good skills can have a string of bad luck and quit. If he would have been able to know that overall he would be successful it might have made him stay in and persevere. Without the ability to know the future, the best way for a poker player to assess his chances for being a winner is to apply Bayesian statistics on the basis of his prior wins and losses.

Most players are not honest with themselves about their winning chances. Many players have delusions about how good they are. They have a false confidence that they can beat the odds even though they don't have the skills. Unlike other forms of gambling like roulette, poker does take skill and a knowledge of math and probabilities. A player "tilts" when he begins losing, becomes emotionally or psychologically stressed and adapts new strategies that are not optimal which causes his game to further deteriorate.

Success is a combination of hard work, talent and opportunity and environment - in other words, both noise and signal are part of success. Focusing on the process as opposed to an expected result puts the energy and effort where it can be most effective. Poker players have an advantage in that they experience more ups and downs more frequently than the average person and have more experience in coping with them and not giving them more focus than they deserve. If a prediction fails, there is no certainty whether the model was flawed, whether there were errors or they predictor was just unlucky - they are all possibilities.

Chapter 11: If You Can't Beat 'Em. . .

Chapter 11: If You Can't Beat 'Em. . . Summary and Analysis

In 2009, a year after the economic collapse, $8 million was traded every second when the Stock Exchange was open. By year's end, more than $46 trillion in stocks had been traded. In the 1950s, the average stock was held for six years before it was traded. By 2000, the average stock was sold after only six months. Basic economics teaches that trading is rational when it benefits both parties. Why so much trading is currently occurring is a mystery.

Bayesian statistics and free-market capitalism stem from the same intellectual tradition. Both Adam Smith and Thomas Bayes were contemporaries, educated in Scotland and admired philosopher David Hume. Both Bayes' and Smiths' processes are consensus-seeking and adhere to the wisdom of the crowd. The stock market is really a forecasting body that makes predictions about the economic future. Even though people are putting their money where their mouths are by investing in the stock market, it is not perfect and not a sure thing.

Aggregate forecasts are often better than single predictions. However, there are three things to remember about aggregates: 1) there is no guarantee that a aggregate forecast is good; 2) forecasts must be made independently before being averaged together; and, 3) an aggregate forecast is not better than the best single forecast. Silver makes his forecasts intellectually interesting through his explanations which draws more people to his blog.

In 1959, a college student named Eugene Fama took a job working for a stock market forecasting service. He combed through data and found statistical patterns that indicated the stock market was highly predictable. However, most of his subsequent predictions failed. The paper her wrote for his Ph.D became the basis for efficient-market hypothesis. In the stock market, past results do not guarantee future performance. Examining how mutual funds performed between 2002 through 2006 with the next five years, Silver found no correlation at all.

Fama had been most critical of "chartists," people who predicted the direction of the stock market based on past statistical patterns without considering the underlying success or failure of the company. There are three forms of efficient-market hypothesis. 1) The weak form claims that stock-market prices cannot be predicted by analyzing prior stats. 2) The semi-strong form argues that fundamental analysis is bound to fail and cannot beat the market. 3) The strong form claims that even insider information will not produce above average predictions.

Opponents of efficient-market hypothesis have two ways they can disprove it: 1) provide evidence that some investors consistently beat the market and 2) demonstrate that

there is predictability in the returns. Stock prices would have to be shown to be correlated from one day to the next or that patterns of gains and losses could be seen over the years. But patterns reverse themselves and inexperienced daily traders often forget to consider the expensive transaction fees that it costs to make trades. Because of reversing trends, an investor who pursued a Manic Momentum strategy could have reduced an original $10,000 investment to $4,000 even before transaction fees. In the end, he would have lost 99 percent of his capital. Strategies like this are risky, high-stakes investments. The unpredictability in stock markets can be directly tied to human activity. Patterns are spotted by everyone playing the market, take advantage of them and thus change trends.

A challenge to the theory of efficient markets is a sustained increase in stock prices which was seen during the dot-com boom during the 1990s and early 2000s. Although technology represented 35 percent of the value of all stocks during that period by 2010, it represented only 7 percent. In order for a bubble to disturb the efficient-market hypothesis, it has to be predictable in real time. Yale economist Robert J. Shiller devised a way to detect bubbles. Shiller is the author of "Irrational Exuberance" which was published at the peak of the dot-com bubble. The P/E (profit to earnings) ratio is typically 15 or under - meaning that based on the company's earnings history, the company would be expected to increase its earnings by 15 percent at some point in the future. But he found that when the P/E ratio is above 25 that conventional wisdom is abandoned and that a high P/E actually predicts a decline and an overvalued market. Alan Greenspan, Head of the Federal Reserve, first used the phrase, "irrational exuberance" to describe technology stocks in 1996. One of the appeals of efficient-market hypothesis is that errors in stock market prices will correct themselves. Most traders are focused on the short term investment.

There are historical odds for a stock market crash. For the trader there are several matters to consider about that possibility. 1) The trader buys and the market rises. It's business as usual and the market makes money. 2) The trader sells and the market crashes. If the trader anticipates a crash, he will look like a genius and get a better job. 3) The trader buys but the market crashes. He lost his firm a lot of money but he followed the stampeding herd and will probably keep his job. 4) The trader sells but the market rises. This is a disaster and his reputation will suffer. "Herding" is following another trader, sometimes a rouge trader who is thought to have inside information or brag about the connections had claims to have.

Over-confidence is potentially the most damaging trait that an investor can have. In fact, it is over-confidence that can upset a rational market. It will produce high volume trading, increased volatility and misleading correlations. The way to stop bubbles is to short stocks but investors don't always have that opportunity because of manipulations by companies. The problem with bubbles is that they sometime take a long time to pop. As John Maynard Keynes said, "The market can stay irrational longer than you can stay solvent." (360) The divergence in prices of two stocks, Palm and 3Com that were essentially the same company, could have only occurred because the price of one of the stocks was wrong.

There are irrational traders in the market known as noise traders. If there is too much noise, investors have to essentially trade in the dark. But if there is betting just on real information, prices are rational. the market is efficient and it would therefore be irrational for anyone to place any trades at all. Economist Joseph Stiglitz offered the solution that some investors be allowed to make a profit to create equilibrium. Some hedge funds beat the market as do some option traders. A select handful of investors do beat the market. Most everyday investors do not do that well. They would do well to resist their "fight or flight" instincts and do the opposite. Many times, inexperienced investors make their buys at just the wrong time, that is, when the market is overvalued. The thinking that tells us that since something is going up that it will continue to go up is wrong-headed. Our instincts to follow the herd can also get us into investment problems. However, a good investor isn't stubborn and doesn't stay with an investment no matter what. He also doesn't stick his head in the sand and pays attention to the underlying context of an investment. Some analysts suggest that investors should be ever-mindful of the two-track market. The first is the signal track which is the market that succeeds in the long-run. It is slow and steady and helps with making long-term investments for retirement and helps companies capitalize themselves. Then there is the fast track, the noisy track, that has lots of movement, high volume and volatility and is much riskier.

Chapter 12: A Climate of Healthy Skepticism

Chapter 12: A Climate of Healthy Skepticism Summary and Analysis

In 1988, NASA climatologist James Hansen testified before Congress that the chance for a natural increase in the global temperature of .4 degrees centigrade that had occurred from the 1950s was about one percent. He told the lawmen that the trend for that time period was evidence of real warming and that it was being caused by the greenhouse effect. Has Hansen's prediction proven to be accurate?

Noisy data can obfuscate the signal. Long before industrialization, there were cycles of warmer and cooler weather. However, there is evidence of the greenhouse effect. In 1990, the United Nations issued a report on climate change. The report was developed by a team of hundreds of scientists from around the world. Two major findings were cited. First, "there is a natural greenhouse effect that keeps the Earth warmer than it otherwise would be." (374) Second, "Emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse cases carbon dioxide, methane, chlorofluorocarbons and nitrous oxide." (375)

The concentrations of greenhouse gases are increasing as a result of human activity. These increases will enhance the natural greenhouse effect and cause additional warming. Also contributing to an enhanced greenhouse effect is the increase of water vapor along with the gases. Scientists require a high burden of proof before they accept a theory. The greenhouse hypothesis easily met that standard. The UN report was something that the majority of scientists accepted. In fact, scientists had recognized the greenhouse effect for over a decade. "Climate change" has replaced the terms "greenhouse effect" and "global warming" in order to more fully embrace the extent of the theory.

There are scientists who are global warming skeptics. Although the evidence is overwhelmingly against that stand, a Bayesian statistician should honor their theories and weigh them in the context of other known data. There are three types of climate skepticism. One type of skepticism results from self-interest. In 2011 alone, the fossil fuel industry spent $300 million lobbying against regulation. A second type of skepticism results from contrarianism which is always a factor in any debate. There is also scientific skepticism which should be respected.

The scientific skepticism is focused on the reliability of computer forecasting models. Scott Armstrong, a professor at the Wharton School at the University of Pennsylvania, is a skeptic. He has devoted much time and effort to the study of forecasting. His book, "Principles of Forecasting" should be read by anyone in the field. He was able to beat the UN forecasts by accurately predicting a no-change forecast for global temperatures

from 2007 to 2012. He concluded that agreement among forecasts does not necessarily translate to accuracy; the complexity of global warming problems makes forecasting impossible; and, the UN forecasts did not consider uncertainty. All climate scientists believe in some aspect of the global warming hypothesis but many are skeptical of the computer models. In addition to the different assumptions made by different models, they all have bugs. There is no reason to believe that a model with millions of lines of codes and instructions would be bug-free.

Weather forecasters and climatologists often disagree. A majority of meteorologists are critical of climate science since it's been difficult enough to forecast the weather for days or weeks. How can climatologists begin to make predictions for years and decades in the future? Meteorologists have two advantages in their forecasting: they get immediate feedback from daily predictions and they have a strong understanding of the physics of weather.

The goal of any predictive model is to capture as much signal as possible while dealing with a minimum of noise. One of the problems in climate change predictions is that temperature levels have a lot of noise and are therefore confounding to the model and to the scientists. Trying to make the model more complex to match the dynamic temperature levels has not had good results. Climate scientists are aware of the uncertainty in their forecasting. But it is possible to analyze this uncertainty which falls into three categories: 1) initial condition uncertainty which consists of short-term factors that distort the greenhouse signal; 2) scenario uncertainty which concerns the level of gases such as CO2 which linger in the atmosphere making it difficult to determine a decrease; 3) structural uncertainty is the concern over how well the dynamics of the climate is understood and how well it is represented mathematically.

NASA, NOAA, the meteorological offices of the US and Japan and satellite observations all confirm that there is a global warming trend that has been measured over the last century and even beyond. Hansen issued a paper with predictions on simple estimates of the effects of CO2. The predictions did quite well, even slightly underestimating the amount of global warming through 2011. The UN's predictions were the first attempt at an international effort to address global warming. These reports were not as detailed as Hansen's but they were generally accurate. Uncertainty in climate change is not a reason for inaction. The government spends billions on wars and economic stimuli that probably have more uncertainty.

One of the main critiques of the theory of global warming is that there was a threat of global cooling in the 1970s. But that didn't pan out. But these predictions were refuted at the time by the majority of scientists and did not have the amount of evidence to support them as does global warming. The answer to some of the skeptics who point to the impossible complexity of climate change prediction models would be to create simpler forecasts. The development of a basic, uncomplicated forecasting model for climate change may refute the criticism of some of the global warming skeptics.

The temperature did not increase at all in the decade between 2001 and 2011. There was a slight decline, in fact. However, historically the warming has come in spurts and

starts, sometimes staying the same and even declining. One decade does not refute the undeniable evidence that exists in favor of climate change. The charges that snowfall is proof that warming does not exist is ridiculous. Global warming is a long-term process. Decisions made today will impact the people of the future. At the core of the fight over climate change are weather patterns and politics. Science and politics have stark and fundamental differences. Progress can be made through scientific research. In politics there is a growing chasm between the two main parties which has resulted in grid lock. Nothing gets done. Scientists state facts with confidence. Politics sometimes state facts and it's considered a gaff. The debate over climate change will probably rage on for decades. "The dysfunctional state of the American political system is the best reason to be pessimistic about our country's future." (411)

Chapter 13: What You Don't Know Can Hurt You

Chapter 13: What You Don't Know Can Hurt You Summary and Analysis

It is possible that the attack on Pearl Harbor in 1941 could have been predicted. Japan was making noise about expansion and they were signaling their intentions by their subversive maneuvering and hostile actions. Total radio silence was the most alarming signal. Conclusions were made about the whereabouts of their fleet. No one concluded that it was heading to Hawaii. Silver met with former Secretary of Defense Donald Rumsfeld about the attack. He commented that the US prepared for sabotage because there were so many Japanese in Hawaii but they didn't prepare for an out-and-out attack.

In her book, "Pearl Harbor: Warning and Decision," Roberta Wohlstetter considered a "signal" as evidence that tells something useful about the enemy. After both the attack on Pearl Harbor and the terrorist attacks of 9/11, a significant minority thought there was evidence that the government knew about both in advance. But as Wohlstetter points out, it's much easier to sort through relevant information AFTER the fact. But in both cases, there were signals that should have been red flags to the government. Unfortunately, much of the evidence was probably ignored and buried in file cabinets. Signal analysis capabilities need to be sharpened in order to make us more prepared for attacks. Rumsfeld pointed out that people have the tendency to mistake the unfamiliar for the improbable. The simple logic was: the US is rarely attacked; Hawaii is part of the US; Hawaii is unlikely to be attacked.

Was 9/11 an unknown? As Rumsfeld said, "There are gaps in our knowledge, but gaps that we don't know exist." (420) He said the 9/11 attack was an "unknown unknown." But out of the frustration that we do not have perfect knowledge of the world, we sometimes fail to make any predictions at all. There were many signals that pointed to the 9/11 attack. 1) There had been at least a dozen warnings about aircraft being used as weapons. 2) The World Trade Center had been targeted in 1993. 3) Al Qaeda was known to be a dangerous and inventive organization. 4) Secretary of State Condoleeza Rice had been warned about increased threats of attack. 5) A flight school student was arrested after it was learned he had terrorist ties.

The threat of a suicide attack may have seemed remote, but there had been a history of such tactics as far back as World War II with Japanese kamikaze pilots. To the terrorist mind-set, it is an honor to die or commit suicide for your beliefs. It is difficult to predict an attack like 9/11 because it is rare and the enemy operates with little signal or noise. The only trend that has emerged about terrorist attacks is that they have escalated in size and severity.

To measure terrorism, it first has to be defined. Terrorist acts are not necessarily perpetrated to increase body count. An act of terror is committed, as the word suggests, to create terror. Most experts define terror as perpetrating acts that are intentional and violent and are carried out by agents not affiliated with a government or military. For an attack to be considered terrorism, its aim must be political, economic, social or religious in nature. No model would have predicted the 9/11 attacks before it occurred. If the attack was the equivalent of a magnitude 8 earthquake, is there an attack of magnitude 9 being plotted? Graham Allison, a professor of political science at Harvard, warned that a nuclear attack would be likely in the decade following 2004. Allison based his prediction on the logic of motive, means and opportunity. There are some 20,000 nuclear warheads in the world that are in the possession of nine countries. But there are a number of these weapons that the US and UN has lost track of. Pakistan is a nuclear state and, at least officially, an ally of the US. But they have shown a reluctance to cooperate with the US and Osama bin Laden was found in Pakistan. Many experts believe that the Pakistani government knew he was there. But a nuclear attack would be hard to pull off because it would require a much wider circle of conspirators which is something that Al Qaeda is averse to. There are estimates of how many people would die in a nuclear blast or from biological warfare that reach one million.

Terrorism has a lasting impact. For example, airport security has changed forever. It is referred to as "show security" because the odds of planes being used as weapons again is very low. People have wondered why shopping malls haven't been targeted by terrorists. For one thing, there aren't that many terrorists. Al Qaeda is thought to have had only between 500 and 1,000 members at its peak. Now it's been degraded and demoralized and is not as effective because it doesn't have the resources to pull of a huge attack. Israel has a different approach to terrorism than does America. Even though they are targeted far more often than Americans, Israelis are essentially unafraid. They are more concerned about their education system than being attacked by terrorists. Small scale terrorism is treated like a crime in Israel. It seems they've been hardened toward it through experience.

There is no more important matter than national security. With relatively little data, it is entirely possible to be overconfident about our national security predictions. The Bayesian approach of probability is the most effective predictor to use when decisions have to be made under the cloud of uncertainty. The 9/11 Commission concluded that our biggest mistake in advance of the attacks was our lack of imagination. Living in fear will not allow us to be free to explore all possibilities.

Conclusion

Conclusion Summary and Analysis

Nate Silver encourages forecasters and analysts to follow the Bayesian theorem and to think probabilistically. The process is not rigid and allows for the forecaster to reassess his forecast when confronted with new data. A fundamental requirement of Bayesian predictions is that the forecaster must have a valid starting point, a prior belief built on past experience and historical data. "Prediction is difficult for us for the same reason that it is so important: it is where the objective and subjective intersect." (453) A successful forecaster must learn to distinguish what is important in his data - the signal - and what is basically meaningless data - the noise. Above all, good predictions can only be made if we aren't under the delusion that they are better than they are.

Characters

Nate Silver

Nate Silver is the author of "The Signal and the Noise" and is also part of the story. Although he does not provide a full biography of his life, there are autobiographical aspects woven throughout the book. After Nate Silver graduated from college, he took a position with KPMG as an economic consultant. He was so bored at his job and had so much free time on his hands that he created the PECOTA system which was a statistical model that measured the skills and abilities of baseball pitchers. In the mean time, Silver became a great success with on-line poker. He quit his job and made a lucrative income playing poker but government regulations changed the world of on-line poker, and he was forced to look for something else to do with his life.

Silver's PECOTA system caught the attention of a scouting organization named Baseball Prospectus who purchased it from Silver with the caveat that he also create a model for hitting and fielding. After he saw that human scouts were sometimes besting him in predictions about player performance, he decided it was time to move on.

With time on his hands, he watched a lot of politics on cable news. He was astounded how wrong the predictions of political pundits were and it struck him that with his skills in math and statistics he could surely do better. He created his FiveThirtyEight blog. Five hundred and thirty-eight is the number of votes in the presidential electoral college. His blog was first featured on the Internet on the Daily Kos after which he launched his own website. He posted predictions with intellectual explanations of his theory and methodology and garnered a lot of attention and traffic. His presidential predictions for the 2008 election were perfect. The New York Times eventually convinced Silver to become part of their organization and his blog is currently on their site. Silver's predictions for the 2012 election were also perfect.

Thomas Bayes

One of the pioneers of modern-day forecasting was Thomas Bayes who was an English minister born in the early 18th century. He was named a Fellow of the Royal Society and often served as a mediator of intellectual debates. It was after his death that his most famous work, "An Essay toward Solving a Problem in the Doctrine of Chances" was published. The work focused on the importance of formulating probabilistic beliefs when encountering new data. He defined probability as gathering data and getting ever closer to the truth.

Bayes understood the close connection between probability, prediction and science. Bayes' theorem was a simple algebraic expression with three known and one unknown variables. It provided the probability of the accuracy of a hypothesis IF some specific event occurred. Many of Bayes' principles are used in modern-day forecasting. Silver is

a big supporter of Bayes and feels that results from Bayes' theorem can provide great predictive insight into a specific matter. As there is always a debate on the major issues, Bayes' theorem supports that our diverse beliefs should converge toward one another; that is, toward the truth.

Pierre-Simon Laplace

French mathematician and astronomer Pierre-Simon Laplace was an advocate of scientific determination and believed that man could predict the universe if the position of every particle were known.

Alan Greenspan

Alan Greenspan was Federal Reserve Chairman when the dot.com phenomenon hit the market. He sensed that the upsurge was a false and temporary one and coined the phrase, "irrational exuberance" to describe it.

Carmen Reinhart and Kenneth Rogoff

In writing their book, "The Time Is Different - Eight Centuries of Financial Folly," economists Carmen Reinhart and Kenneth found that high unemployment lasting for four to six years often follows financial crises.

Barack Obama

President Barack Obama had just been inaugurated into office when the economy nearly collapsed. Because of poor economic predictions, the stimulus that he generated to urge recovery was too small and did not have the desired result.

Gary Huckaby

Nate Silver sold his PECOTA system that predicted the performance of baseball pitchers to Gary Huckaby, who was the founder of the Baseball Prospectus. The only condition on the purchase was that Nate agree to create a system to predict the performance of hitters and fielders.

Graham Allison

Graham Allison, a professor of political science at Harvard, warned that a nuclear attack would be likely in the decade following 2004. Allison based his prediction on the logic of motive, means and opportunity and the fact that there were missing nuclear warheads.

Scott Armstrong

Scott Armstrong, a professor at the Wharton School at the University of Pennsylvania, is a credible skeptic of climate change. He is a respected forecaster and and the author of the popular book, "Principles of Forecasting." He was able to beat the UN forecasts for increasing temperatures by accurately predicting a no-change forecast for global temperatures from 2007 to 2012.

Roberta Wohlstetter

Roberta Wohlstetter is the author of the book, "Pearl Harbor: Warning and Decision." Wohlstetter considered a "signal" to be evidence that reveals something useful about the enemy.

Objects/Places

Signal and Noise

When analyzing data and creating forecast models, analysts and researchers need to learn to distinguish between the noise and the signal. The noise consists of superficial and confusing factors that have little if any importance. The signal is strong data that is relevant to the subject at hand and should be focused upon in forecasting.

Collateralized Debt Obligation

A Collateralized Debt Obligation, or CDO, is a complex type of security. During the economic collapse, they were over-valued 200 times higher than predicted. The failure of the CDOs resulted in trillions of dollars of investments that were rated as safe whey they were actually very unsafe. These overvalued CDOs help lead the economy to near collapse.

The Housing Bubble

The housing bubble that helped lead to the economic downturn in 2007 was in part created by speculators who flipped houses for quick profit. The fact that mortgages were easier to obtain also helped to expand the bubble.

The Dot.com Bubble

The dot.com bubble occurred in the late 1990s and early 2000s. Technology stocks gained unheard of strength and had a 35 percent share of the overall market. It crashed a few years later and wound up with a more reasonable share of the market at 7 percent. The dot.com bubble caused Federal Reserve Chairman Alan Greenspan to refer to the unexplained increase in the market share by technology stocks as "irrational exuberance."

Foxes and Hedgehogs

"Hedgehogs" are type A personalities and believe in big, bold ideas. "Foxes" believe in small ideas and in taking a multifaceted approach to problems. Foxes are more successful in their predictions while hedgehogs make better television guests because they are bold in their predictions and more entertaining. Foxes are not as entertaining because they appear less confident and their predictions are nuanced. Foxes are more likely to ignore the "noise" and and not chase false signals.

PECOTA

Silver created PECOTA which was a projection system that he developed for the Baseball Prospectus organization. Silver's system had predicted stardom for Boston Red Sox player Dustin Pedroia, a rookie that no one other analysts or experts considered a future star.

FiveThirtyEight Blog

Nate Silver created his political prediction blog that first appeared on the Internet on the Daily Kos. He launched his own website but was convinced by the New York Times to blog on their website. Five-hundred and thirty-eight is the number of presidential electoral votes.

The Bayesian Theorem

Bayes' theorem is a statistics model that can provide great predictive insight. It is a theory that is concerned with "conditional probability." It provides the probability of the accuracy of a hypothesis IF some event occurs.

Frequentism

"Frequentism" is a predictive model created by English statistician Ronald Aylmer Fisher. It is also referred to as "Fisherian" statistics. With frequentism, Fisher's goal was to rid the predictive process of bias. However, it was not particularly objective and it discouraged the analyst from considering relevant underlying data.

Climate Change

The United Nations issued a report on climate change. The report was developed by a team of hundreds of scientists from around the world. Two major findings were cited in the report. The scientists confirmed that the world was getting warmer which was the result of the greenhouse effect that kept the earth warmer. Emissions from human activities was found to be accelerating the process.

Themes

The Signal and the Noise

Predictions that fail can sometimes point to analysts or researchers who were led astray by their own lack of discipline. The noise that surrounds a process can obfuscate the important signal that must be the focus or a main factor of the forecast. Heavy clouds black clouds that line the skies over the Gulf of Mexico could generate a weather forecast of heavy rain by an inexperienced or inept weatherman. However, the astute meteorologist will ignore that superfluous indicator and look deeper and learn that a hurricane is forming in the Gulf and heading for New Orleans. While the clouds were ominous, dark and certainly dramatic, they were just noise. The signal is the hurricane that is forming and will be a danger to the people.

A forecaster who learns to distinguish between the signal and the noise will have a leg up on other analysts who, to their detriment, are lured by the noise and ignore the real story. It is not just ineptitude that makes a researcher miss the relevant information, it is a form of hubris that sends him down the wrong pathway. Personality traits are reliable predictors of forecasting ability. "Hedgehogs" or type A personalities believe in big, bold ideas. "Foxes" believe in small ideas and in taking a methodical and multifaceted approach to their predictions. Foxes are more successful in their predictions while hedgehogs seek fame and fortune and the limelight. They make better television guests because they are bold in their predictions and intentionally are more entertaining. Foxes are more likely to ignore the "noise" and and not chase false signals.

When a prediction theory is underdeveloped and there is a sparsity of good data, like for earthquakes, people are desperate to make a forecast and mistake noise for a signal which leads to false alarms and actually sets the science back because the error in judgment caused a loss in credibility. The term for mistaking noise for signal in statistics is "overfitting." It is an allusion to the practice of forcing statistical models to match prior observations - the square peg into the round hole syndrome.

Nate Silver advices anyone who is interested in the field of forecasting to make sure that they ignore the noise and listen very closely for the signal.

Good and Bad Prediction Models

Wouldn't it be great if we could predict everything. In 1941, we would have known that the Japanese Navy was heading for Hawaii and we could have been filing our nails while waiting for the masts of the Japanese warships to breach the horizon at which point we could have fired and been done with them. There would have been no attack on Pearl Harbor, we would have degraded the enemy and there would have been no loss of U.S. military lives. The same goes for the attacks of 9/11. We would have

stopped the terrorists as they tried to board the planes and arrested them. There would have been no destruction and no loss of life.

But that, of course, is just fantasy. National security is not a subject that is conducive to prediction. There had never been an attack on US soil in 1941. In 2001, there had only been one attack on U.S. soil. Therefore, there was virtually no data to be used to create a predictive model. There were rumors and speculation before both events but nothing to grab onto as to if, where, when and how. A forecasting model can do a lot but it needs a premise to base its predictions upon.

Weather is a subject that enjoys great forecasting success. There are two main reasons why weather predictions have an excellent level of success: science and historic data. Weather forecasters have worked for years to project what the weather will be for the next day and week. Some forecasting even predicts weather a month ahead - but those are usually just averages of historic data. Weather forecasting is accurate because trends can be spotted that can be supported by historic weather patterns. Technological advancements have helped make weather forecasts accurate. Hurricanes are the most predictable. They can be seen coming for days. Hurricane prediction models detect the path of the storm and can predict where and when it will hit shore down to the hour.

Another form of weather predicting has not yet proven to have much success. Climate change forecasts have shown a trend of general global warming for decades. But there are stops and starts in the trends. Temperatures can actually stay the same or decrease over a decade. Still, most scientists agree that climate change is occurring. But there are credible skeptics which somewhat throw into question the predictions that are issued about climate change.

Scientists have tried for years to pick up trends and patterns about the incidence of earthquakes. But their occurrence is erratic. Some quakes have aftershocks but some have fore-shocks. Some locations have large magnitude quakes after experiencing a cluster of smaller magnitude tremors. But other locations that have a cluster of small quakes never have that big one. Scientists keep trying to look for the key that would allow them to predict earthquakes and their magnitude but not much progress has been made thus far. Uncertainty causes difficulty in making accurate predictions in the fields of economics, national security and politics. The source of this uncertainty is man's role in these fields which causes their progress to be dynamic and ever-changing.

As Nate Silver said, even though we don't have all the information we need, we should continue to make forecasts about important matters that impact our society. New data will allow us to keep improving the predictive models. We need to make predictions because there is so much we don't know about the universe.

Uncertainty and Context

One of the most prevalent themes that is woven throughout "The Signal and the Noise" is that predictions often fail because the trending data that is gathered about a subject -

be it economic, weather-related, political or others - is not taken in a historic context or in the context of the current environment or in the perspective of side issues that impact the forecasting model. Going hand in hand with a need to consider context, is the importance of recognizing that uncertainty may exist about the matter which can be either underlying or somewhat overt.

Why taking the issues of context and uncertainty into consideration when running a statistical model that will provide predictive data is because these issues can greatly impact the results of a forecast. An example is when gathering stats on a baseball player - his batting average, fielding abilities, his power hitting and other measurable performance data - an analyst has to understand the context of his performance. Does he hit better in home games? Does he hit more homers when he is away? Luck is also a factor in forecasting and a good predictor learns how to separate skill from luck by considering the context. The performance stats must be viewed in the context of a player's age and health and injuries at different points along his career.

"Frequentism" which was conceived by English statistician and biologist Ronald Aylmer Fisher encourages assumptions which discourages the analyst from considering predictive data in its underlying context. A good economic analyst doesn't stubbornly hold onto preconceived notions or prior predictions and pays attention to the underlying context of an investment.

When assumptions are made about uncertainty as was done frequently throughout the economic collapse, predictions can be misleading and even erroneous. There are certain subjects that are especially vulnerable to uncertainty. Economics is one field which is dynamic and volatile because

human intervention is involved and is not generally predictable. Another issue the is filled with uncertainty are the incidence of earthquakes. Since there are no proven trends or history that provides data that can adequately predict when an earthquake will strike, there has been little or no advancement in the prediction of earthquakes.

As Silver's subtitle suggests, some predictions fail and some don't. Two reasons for a failure in forecasting are ignoring context and not adequately weighing uncertainty.

Style

Perspective

"The Signal and the Noise - Why So Many Predictions Fail - But Some Don't" by Nate Silver is a non-fiction book about the world of predictions and forecasting. Also included in the book are episodes of Silver's real life experiences. He narrates the story. As a predictor, writer and statistician himself, no one could tell his story better.

Silver dabbled in forecasting and predictive models for many years. After deciding he wasn't made for an ordinary desk job at KPMG, Silver became a whiz kid on in-line poker sites and made a small fortune. His winnings were largely due to his ability to predict how his hand would play out and assess his opponent's hand and his ability to play it out. After he began to lose as much as he was winning, he went on to predict the performance of baseball players and then onto political predictions. His FiveThirtyEight blog that focused on political issues and elections caught the eye of the New York Times who convinced him to blog on their website.

It is obvious that Silver is not only a practitioner of forecasting he is a huge fan. He is a self-described nerd and geek which is illustrated with the enthusiasm he shows for what many would consider boring and tedious. That statement is a compliment to Silver which is exactly how he would take it. Nate Silver was named one of the world's 100 Most Influential People by Time magazine.

Tone

Nate Silver is an admitted geek and mathematics nerd. He's not being self-deprecating - he's proud of it. But Silver is much more than a math geek, he is a gifted statistician and analyst and provides knowledgeable and in-depth insight into forecasting modeling and predictions. Silver doesn't just rely on his experience with predictions and statistics, he includes a thorough history of forecasting and explains the failures and successes of forecasting models and the why of it. Silver is an experienced forecaster especially on the performance of baseball players, poker playing and in the outcomes of political elections. It is obvious that Silver is intrigued and fascinated by predictions and forecasting. He is a great admirer of a pioneer in the field, Thomas Bayes, and is a strong advocate of his approach to making predictions.

Silver pulls no punches when it comes to his own background. He admits that he was bored with his job as an economic consultant and had so much time on his hands that he created a system for predicting the performance of baseball players while on the job. He also became rather obsessed with on-line poker and speaks of how he quit his job, made hundreds of thousands of dollars and was on his way to losing it when he decided that his life needed to go in another direction.

Silver is brutally honest in his feelings about political pundits that he observed on cable news shows. He was astounded at how often they were wrong which is what compelled him to create his own prediction model for political elections and issues. The performance bar that was set by the pundits, he felt, was so low that he was sure he could outdo them.

Silver provides frank and honest assessments about the world of forecasting. But the opinions he provides are not just his impressions. Not surprisingly, this statistician backs up his opinions with facts and figures - and statistics.

Structure

"The Signal and the Noise - Why So Many Predictions Fail - But Some Don't" by Nate Silver is a lengthy and complex look at predictions, their importance and how they impact our lives. The book is separated into thirteen long chapters each of which is devoted the various topics for which forecasts are made and predictions are declared.

Silver goes into great depth and detail about the most common sociopolitical forecasts that are currently developed by analysts and forecasters. He describes the 2007 economic collapse and looks into the predictions that were made about the market. Silver explains how economics predictions are a challenge since the subject matter is dynamic and riddled with uncertainty. Silver delves into predictions that are made about the performance of sports figures, particularly baseball players. Silver himself developed statistical model a la "Moneyball," that provided predictions about the abilities of new players that earned the interest of Major League Baseball.

The author explains that weather forecasting has been perhaps the most successful of all subjects for which prediction models are developed. He compares weather forecasting that has history, trends and science behind it to earthquake predictions that has too much uncertainty and no discernible trends to have much value. He discusses climate change at length - its controversy and its dynamic nature that also makes forecasting a challenge. Finally, he ends the book with a section on national security and explores the ways in which the government could separate the signal from the noise in order to identify serious threats from terrorists and other enemies.

There is an introduction from the author that precedes the first chapter. There are numerous charts and graphs throughout the book that Silver uses to illustrates the points he makes. There is an "Acknowledgments" section, "Notes" and an Index.

Quotes

"We focus on those signals that tell a story about the world as we would like it to be, not ow it really is. We ignore the risks that are hardest to measure even when they pose the greatest threats to our well-being." (Chapter 1, page 20)

"The major difference between a thing that might go wrong and a thing that cannot possibly go wrong is that when a thing that cannot possibly go wrong goes wrong it usually turns out to be impossible to get at or repair." (Chapter 1, page 26)

"'I think I had five congressional hearings after Katrina,' said Max Mayfield, who was director of the National Hurricane Center at the time the storm hit, when I asked him to recall when he first recognized the full magnitude of the threat. 'One of them asked me when I first became concerned about New Orleans, I said sixty years ago.'" (Chapter 4, page 109)

"Improved computing power has not really improved earthquake or economic forecasts in any obvious way. But meteorology is a field in which there has been considerable, even remarkable, progress." (Chapter 4, page 111)

"In science, we seek to balance curiosity with skepticism." (Chapter 5, page 168)

"Extrapolation is a very basic method of prediction—usually, much too basic. It simply involves the assumption that the current trend will continue indefinitely, into the future. Some of the best-known failures of prediction have resulted from applying this assumption too liberally." (Chapter 7, page 212)

"The number of possibilities in an entire chess game, played to completion, is so large that it is a significant problem even to estimate it, but some mathematicians put the number as high as 1010. These are astronomical numbers: as Diego Rasskin-Gutman has written, 'There are more possible chess games than the number of atoms in the universe.'" (Chapter 9, page 269)

"The perfect is the enemy of the good." (Chapter 9, page 272)

"I lived the poker dream for a while, and then it died. I learned that poker sits at the muddy confluence of the signal and the noise. My years in the game taught me a great deal about the role that chance plays in our lives and the delusions it can produce when we seek to understand the world and predict its course." (Chapter 10, page 295)

"Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth." (Chapter 10, page 307)

"In 2009, a year after a financial crisis had wrecked the global economy, American investors traded $8 million in stocks every second that the New York Stock Exchange was open for business." (Chapter 11, page 329)

"That term has totally lost its meaning. . . A bubble is something that has a predictable ending. If you can't tell you're in a bubble, it's not a bubble." (Chapter 11, page 347)

Topics for Discussion

What caused the 2007 economic collapse? What part did predictions and forecasting play?

What is the Bayesian theorem? What was the predictive theory of Pierre-Simon Laplace?

What is "frequentism"? Who was the creator of this forecasting theory and how did he feel about the methodology of Bayes and Laplace?

Which predictive philosophy does Nate Silver ascribe to and why?

Why is it important to understand the context of an issue for which a prediction is being made? How does uncertainty impact prediction models?

What caused the dot.com bubble and the housing bubble? What are the dangers of bubbles and why are they difficult to detect and why do they take a long time to burst?

What forecasting has had the most successful results and why? What are some matters that are difficult to predict and why?

What are the different views on global warming? What are the three reasons for skepticism that people have about global warming? Why is climate change a political issue?