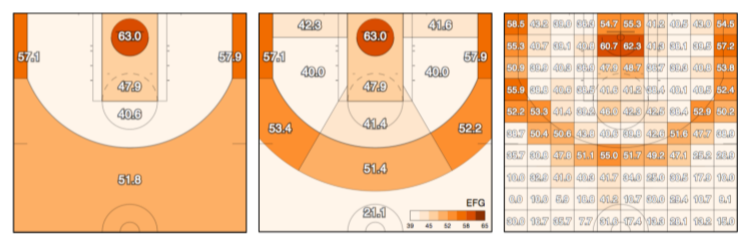
**Literature Review Outline**

* 1st page: in my own words, intro to topic, draw the reader in
* 2nd page: general overview of analytics in sports and in basketball
  + *How Analytics Has Changed Sports*
    - “One way to look at sports analytics is as a series of battles over the right way to understand sports”
* 2nd page: why analytics is important in evaluating individual player performance
  + *Evaluating Basketball Player Performance via Statistical Network Modeling*
  + *POINTWISE: Predicting Points and Valuing Decisions in Real Time with NBA Optimal Tracking Data*
    - While most analytical models focus on the results of the end of a possession, such as points, turnovers, or assists, this model considers players’ decisions to pass, dribble, or shoot over the course of the possession. By using the metric of expected possession value (EPV), this source offers a different type of analysis of offensive play in basketball.
  + *The Dwight Effect*
    - typically focuses on offense, but data analytics relates to defense too
* 3rd & 4th page: How sports analytics is so important to shot selection and shot quality
  + *The Problem of Shot Selection in Basketball*
    - Skinner investigates the decision making of players, particularly through their decision of whether a shot is worth taking. The analysis explores what shots are worth taking and which shots should be passed up. A theoretical model of the shot selection process is used to identify trends in the NBA.
  + *Quantifying Shot Quality in the NBA*
    - “The primary challenge for sports teams on offense is to maximize the value of each opportunity when they possess the ball and equivalently to minimize that value when their opponent possesses it. In basketball, while generating free throws, not turning the ball over and rebounding are significant, efficiency is primarily determined by the value from shooting the ball as the vast majority of possessions end in field goal attempts”
    - Introduces ESQ = Effective Shot Quality & EFG+ = EFG-ESQ
    - Dirk = example, uses defender distance to truly measure the shooting ability of players
  + *CourtVision: New Visual and Spatial Analytics for the NBA*
    - Spatial Analysis
    - “CourtVision,” a new ensemble of spatial and visual analytics designed to reveal, quantify, visualize, and communicate on-court performance with unprecedented precision and clarity”
    - “The most commonly used NBA shooting metrics, including field goal percentage (FG%) do not account for spatiality. Although conventional metrics are simple ways to summarize the probability of a shot attempt resulting in a made basket they fail to expose true differences in shooting ability across the league”
  + *Factorized Point Process Intensities: A Spatial Analysis of Professional Basketball*
* 5th page: move to the 3
  + Houston Rockets
  + *Live by the Three, Die by the Three? The Price of Risk in the NBA*
* 5th page: How shooting changes based on game situation
  + *Big data analytics for modeling scoring probability in basketball: The effect of shooting under high-pressure condition*
  + *Crunch time in the NBA – The effectiveness of different play types in the endgame of close matches in professional basketball*
* 6th page: DEATH OF THE MIDRANGE
  + <https://www.vice.com/en_au/article/pgj338/numbers-game-how-spatial-analytics-killed-the-mid-range-jump-shot>
  + <https://the-cauldron.com/lost-art-the-mid-range-jumper-64b64fa0f081>
  + <https://flowingdata.com/2019/01/15/goodbye-mid-range-shot/>
  + <https://nbamath.com/the-nbas-changing-art-of-mid-range-jumpers/>
* 8th page: Uses of it
  + <https://www.theringer.com/2019/4/25/18514670/san-antonio-spurs-pop-nuggets-game-6>

**Analytics in Sports**

In the past decade, analytics has changed the way professional and collegiate athletes are studied and evaluated. In the past few years, analytics have become so prevalent that it has begun to have a distinct influence on the way games are played.

Statistics have been around since the beginning of professional sports. The first dated record keeping of sports statistics came back in 1859, when a British-born journalist named Henry Chadwick began recording basic statistics for the baseball games he reported on. His record keeping included basic statistics such as runs, hits, errors, strikeouts, and batting average, which are all still the base statistics used to evaluate baseball performance to this day. In 1938, Chadwick was posthumously inducted into the National Baseball Hall of Fame for his contributions to the way the sport was written about. (<https://www.liveabout.com/baseball-statistics-glossary-321381>)

Of the four major American sports leagues, Major League Baseball was the first to begin in 1869, meaning that basic statistics have been around since the first game of American professional sports. Statistics are the basis for player evaluation by the national media as well as the everyday fan. In baseball, the most popular and highest paid players are those who hit for the highest average and hit the most home runs. In football, it’s who scores the most touchdowns or accumulates the most yards. In hockey, it’s who scores the most goals, and in basketball, it’s who accumulates the most points, rebounds, and assists.

Sports analytics was largely brought into the public eye by the infamous movie *Moneyball* staring Brad Pitt and Jonah Hill, released in 2011. The film is based on Michael Lewis’s book *Moneyball: The Art of Winning an Unfair Game*, which chronicles the success of the Oakland Athletics in 2002. The team’s general manager, Billy Beane, fully embraced an analytical, sabermetric-based approach to evaluating players, and in doing so assembled a team of underappreciated players that finished with a regular season record of 103-59, despite having one of the lowest payrolls in the MLB. The term “Moneyball” has become synonymous with sports analytics, and the 2002 Athletics represent one of the first major successes of an analytical-based strategy for a professional sports organization.

Statistics have constantly evolved in the four major leagues; major statistical breakthroughs this century include baseball’s WAR (Wins Above Replacement) metric, as well as basketball’s PER (Player Efficiency Rating). Not only do these advanced statistics give scouts, teams, and fans new ways to evaluate player performance, but they play in a role in team’s signing and trading of players, as well as the selection of league award recipients. For example, the Milwaukee Bucks’ Giannis Antetokounmpo was awarded the NBA’s Most Valuable Player Award for the 2018-19 season with a league leading PER of 31.71, despite averaging 8.4 points per game less than the runner-up James Harden. These advanced metrics give a more wholesome evaluation of a player’s performance, incorporating more than just the base statistics that have been used to evaluate players in the past (such as points per game in basketball).

Across the four major professional leagues, investment in sports analytics has risen tenfold in recent years. Leigh Steinberg summarizes the benefits of investing in statistical analysts in his Forbes article *Changing the Game: The Rise of Sports Analytics*:

Today, every major professional sports team either has an analytics department or an analytics expert on staff. Teams often have to scan scout notes from clipboards, [convert those PDF’s to Excel](http://www.cogniview.com/), and then hand those files over to top-notch data developers. Thereafter, another set of young talented mathematicians crunch numbers that scouts and general managers use to help determine which players they think fit their club best. This is all a part of creating an overall profile of a player to determine if that player is worth drafting, signing as a free agent, or acquiring in a trade. Analytics are the present and future of professional sports. Any team that does not apply them to the fullest is at a competitive disadvantage. (CITE: <https://www.forbes.com/sites/leighsteinberg/2015/08/18/changing-the-game-the-rise-of-sports-analytics/#236090ff4c1f>)

The nature of sports is to gain an advantage over the opponent, and as Steinberg highlights, a team is not maximizing its advantage unless they incorporate analytics into their evaluation strategy.

The National Basketball Association has embraced analytics unliked any other professional sports league. Whether it’s tracking of player movement, analysis of specific shot locations on the court, or lineup analysis to identify a team’s most effective combination of players, analytics are a major driver behind almost every basketball-related decision an NBA organization makes. Matt McLaughlin captures the rise of data analytics in the NBA in his BizTech article *How Data Analytics Is Revolutionizing Sports*:

The NBA has embraced data analytics in a way that surpasses most other major U.S. sports leagues… Data analysis is largely credited with the significant increase around the league in 3-point shooting, which has risen in each of the last eight seasons. Nearly every team in the NBA has hired data analysts as full-time staff members to work with coaches and front office staff. These analysts help teams identify trends that may improve on-court tactics or practice habits. They also help general managers spot undervalued players, so a team can make a trade that works in its favor. (CITE: <https://biztechmagazine.com/article/2018/12/how-data-analytics-revolutionizing-sports>)

Data analytics is crucial for success in today’s NBA, and teams such as the Golden State Warriors and Houston Rockets have taken the lead in the NBA’s recent data analytics revolution.

In short, the rise of sports analytics has completely changed the way sports are played and evaluated in the past decade. MIT technology writer Peter Dizikes refers to sports analytics as “the game within the game” (Dizikes, 2016, 1). In order for current professional and collegiate teams to maximize their advantage over their opponents, they need to dedicate significant attention and resources to data analytics. Not only is data analytics crucial for current success, but it is the future of sports; teams must adapt now or be left in the past.

**Analytics in Basketball**

NBA Commissioner Adam Silver says it himself: “Analytics are part and parcel of virtually everything we do now… I think it is part of the result” (CITE: [https://www.youtube.com/watch?v=mUSFAYslACQ](https://www.youtube.com/watch?v=mUSFAYslACQ/)). No league in the world has embraced the recent data analytics movement like the National Basketball Association. From analyzing ticket sales to increase team revenue, to using wearables to monitor players’ sleep schedules, the NBA has incorporated analytics in nearly every aspect of its product.

NBA front offices, coaches, and fans have always used statistics to supplement their evaluation of players. That said, until the mid-2010s, those statistics were predominantly basic box score numbers: points, rebounds, assists, steals, blocks, field goal percentage, etc. One of the major breakthroughs that helped start the current data analytics revolution is the league’s investment in video tracking technology. Prior to the start of the 2013-2014 season, the NBA implemented SportsVu software into every NBA arena, a brand specializing in video tracking tools. (CITE: <https://www.smartdatacollective.com/how-nba-data-analytics-revolution-has-changed-game/>). Since the initial investment into video tracking, the NBA has only expanded its partnerships with data-focused companies, including SecondSpectrum and Sportradar. The league’s six-year partnership with Second Spectrum and Sportradar are “worth in excess of $250 million to the NBA” according to Forbes. (CITE: <https://www.forbes.com/sites/darrenheitner/2016/09/22/the-nbas-six-year-250-million-data-deal/#1f6c6481481d>).

The leading pioneer for the NBA’s data revolution is Houston Rocket’s General Manager Daryl Morey. Coming from an analytical background, Morey was hired as GM of the Rockets in 2007. Following three consecutive losing seasons, Morey upheaved the Rocket’s offensive strategy prior to the 2012-2013 season, installing a system centered around taking highly efficient shot attempts, meaning predominantly 3-pointers and layups. Morey also traded for budding all-star guard James Harden and reconstructed the Rocket’s roster to complement his star guard. In his development of the Rocket’s groundbreaking strategy, Morey alienated certain shots on the court:

Morey’s most fundamental insight involved taking an increased number of three-point shots. Three-point shots in basketball are more difficult because they are further away from the basket, but Morey recognized that the 50% uplift in points received for the three-point shot (compared to a two-point shot) made it more mathematically efficient than almost all two-point shots other than dunks and lay-ups. (CITE: <https://digital.hbs.edu/platform-digit/submission/moreyball-the-houston-rockets-and-analytics/>)

Morey’s Rockets are the first example of a team abandoning the mid-range jumper, the topic that this paper focuses on. Houston’s strategy has resulted in sustained success; to date, the team has the third-best record in the NBA since 2012, with only the Golden State Warriors and San Antonio Spurs posting more wins. The Rocket’s strategy has been dubbed *Moreyball*, a reference to the Oakland Athletics infamous *Moneyball* strategy.

* 2nd page: why analytics is important in evaluating individual player performance
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    - While most analytical models focus on the results of the end of a possession, such as points, turnovers, or assists, this model considers players’ decisions to pass, dribble, or shoot over the course of the possession. By using the metric of expected possession value (EPV), this source offers a different type of analysis of offensive play in basketball.
  + *The Dwight Effect*
    - typically focuses on offense, but data analytics relates to defense too

Question: what is the best way to approach this? Should I just frame it as examples of statistical modeling that has been done previously?

**Evaluating Performance in Basketball**

References

Cervone, Dan, et. al. “POINTWISE: Predicting Points and Valuing Decisions in Real Time with

NBA Optical Tracking Data.” *Harvard University,* MIT Sloan Sports Analytics Conference, 28 February 2014, Boston, MA, USA.

Clemens, Austin. “Interactive NBA Shot Charts.” *Austinclemens.com*,

www.austinclemens.com/shotcharts/.

Chang, Yu-Han Chang, et. al. “Quantifying Shot Quality in the NBA.” *Second Spectrum, Inc.*,

MIT Sloan Sports Analytics Conference, 28 February, 2014, Boston, MA, USA.

Dizikes, Peter. “How Statistical Analytics Has Changed Sports.” *Athletic Arena*, USA Today, May

2016.

Goldman, Matthew, & Justin M. Rao. “Live by the Three, Die by the Three? The Price of Risk in

the NBA.” *42 Analytics*, MIT Sloan Sports Analytics Conference, 1 March 2013, Boston, MA, USA.

Goldsberry, Kirk & Eric Weiss. “The Dwight Effect: A New Ensemble of Interior Defense

Analytics for the NBA.” *Harvard University*, MIT Sloan Sports Analytics Conference, 1 March 2013, Boston, MA, USA.

Goldsberry, Kirk. “CourtVision: New Visual and Spatial Analytics for the NBA.” *Harvard*

*University,* MIT Sloan Sports Analytics Conference, 2 March 2012, Boston, MA, USA.

Goldsberry, Kirk. “How Mapping Shots In The NBA Changed It Forever.” *FiveThirtyEight*,

FiveThirtyEight, 2 May 2019, fivethirtyeight.com/features/how-mapping-shots-in-the-nba-changed-it-forever/.

Levy-Rubinett, Isaac. “The Push and Pull of the Spurs' Midrange Against the Machine.” *The*

*Ringer*, The Ringer, 25 Apr. 2019, www.theringer.com/2019/4/25/18514670/san-antonio-spurs-pop-nuggets-game-6.

McCagh, Wade. “How Spatial Analytics Killed The Mid-Range Jump Shot.” *Vice*, 26 Sept.

2016, www.vice.com/en\_au/article/pgj338/numbers-game-how-spatial-analytics-killed-the-mid-range-jump-shot.

Miller, Andrew, et. al. “Factorized Point Process Intensities: A Spatial Analysis of Professional

Basketball.” *Harvard University*, 8 January 2014.

Moore, Jack. “Lost Art: The Mid-Range Jumper.” *Medium*, The Cauldron, 30 July 2014, the-

cauldron.com/lost-art-the-mid-range-jumper-64b64fa0f081.

“NBA & ABA Year-by-Year Top 10 Leaders and Records for Effective Field Goal Pct.”

*Basketball Reference*, www.basketball-reference.com/leaders/efg\_pct\_top\_10.html.

Piette, James, et. al. “Evaluating Basketball Player Performance via Statistical Network

Modeling.” *University of Pennsylvania*, MIT Sloan Sports Analytics Conference, 4 March 2011, Boston, MA, USA.

Ross, Terrance F. “Welcome to Smarter Basketball.” *The Atlantic*, Atlantic Media Company, 25

June 2015, www.theatlantic.com/entertainment/archive/2015/06/nba-data-analytics/396776/.

Skinner, Brian. “The Problem of Shot Selection in Basketball.” *Fine Theoretical Physics*

*Institute, University of Minnesota*, PLoS ONE, 25 January 2012, Minneapolis, Minnesota, USA.

Urbina, Frank. “The NBA's Changing Art of Mid-Range Jumpers.” *NBA Math*, 12 Feb. 2017,

nbamath.com/the-nbas-changing-art-of-mid-range-jumpers/.

Yau, Nathan. “Goodbye, Mid-Range Shot.” *FlowingData*, 28 Jan. 2020,

flowingdata.com/2019/01/15/goodbye-mid-range-shot/.

Links to Cite:

<https://biztechmagazine.com/article/2018/12/how-data-analytics-revolutionizing-sports>

<https://www.forbes.com/sites/leighsteinberg/2015/08/18/changing-the-game-the-rise-of-sports-analytics/#3a1024d84c1f>

<https://www.espn.com/nba/story/_/id/26633540/the-nba-obsessed-3s-let-fix-thing>

<https://www.liveabout.com/baseball-statistics-glossary-321381>

[https://www.youtube.com/watch?v=mUSFAYslACQ](https://www.youtube.com/watch?v=mUSFAYslACQ/)

<https://www.smartdatacollective.com/how-nba-data-analytics-revolution-has-changed-game/>

<https://www.forbes.com/sites/darrenheitner/2016/09/22/the-nbas-six-year-250-million-data-deal/#1f6c6481481d>