Are NBA Video Games Representing the Real Game? A Statistical Comparison of Phoenix Suns' Shooting Patterns and their Video Game Counterpart

By

John Harrington

APPROVED:

Dr. Dieter Armbruster
Co-Director

Dr. Ioannis Kamarianakis
Co-Director

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John Harrington
Arizona State University
Barrett, The Honors College
Co-Director: Dr. Dieter Armbruster
Co-Director: Dr. Ioannis Kamarianakis

Table of Contents

Abstract

This paper intends to analyze the Phoenix Suns' shooting patterns in real NBA games, and compare them to the "NBA 2k16" Suns' shooting patterns. Data was collected from the first five Suns' games of the 2015-2016 season and the same games played in "NBA 2k16". The findings of this paper indicate that "NBA 2k16" utilizes statistical findings to model their gameplay. It was also determined that "NBA 2k16" modeled the shooting patterns of the Suns in the first five games of the 2015-2016 season very closely. Both, the real Suns' games and the "NBA 2k16" Suns' games, showed a higher probability of success for shots taken in the first eight seconds of the shot clock than the last eight seconds of the shot clock. Similarly, both game types illustrated a trend that the probability of success for a shot increases as a player holds onto a ball longer. This result was not expected for either game type, however, "NBA 2k16" modeled the findings consistent with real Suns' games. The video game modeled the Suns with significantly more passes per possession than the real Suns' games, while they also showed a trend that more passes per possession has a significant effect on the outcome of the shot. This trend was not present in the real Suns' games, however literature supports this finding. Also, "NBA 2k16" did not correctly model the allocation of team shots for each player, however, the differences were found only in bench players. Lastly, "NBA 2k16" did not correctly allocate shots across the seven regions for Eric Bledsoe, however, there was no evidence indicating that the game did not correctly model the allocation of shots for the other starters, as well as the probability of success across the regions.

Motivation

The purpose of this paper is to statistically analyze how well current video games model shooting patterns for the Phoenix Suns during their first five games of the 2015-2016 season. Currently, there is extensive research regarding what factors are significant to a shot's success in the NBA, however, there is no research checking this findings in "NBA 2K16", or comparing the way the video game models a team's shooting patterns to its NBA counterpart. This paper intends to analyze how well the video game models real life shooting patterns, while it also will check these establish findings for the first five Phoenix Suns' games, both in real life and NBA 2K16. These relationships will be statistically analyzed to determine their effect.

Additionally, I have played the 2k basketball games over the past five years and wondered how well the game modeled real NBA gameplay. In "NBA 2k15", I believed that the "CPU" did not model gameplay well, which encouraged me to look at the differences. When looking into this game, I discovered that a new person, Mike Stauffer, had been hired to oversee player ratings and "NBA 2k16" would be the first game he worked on. My thesis intends to analyze how his changes compare to real NBA games.

Introduction

While many professional sports have been trending towards advanced analytics to determine strategy, basketball was one of the earliest sports to incorporate statistics. Due to this, many teams have incorporated analytics into how, when, and where shots are attempted. One of the most important factors determining when teams should take a shot is the shot clock. The shot clock was introduced to the NBA in 1954 when NBA games were ending in the teens and teams would stall the ball after halftime. Danny Biasone came up with the idea for the 24-second shot clock, and, when introduced, resulted in more shots and higher scoring games (History, 2001).

With the introduction of the shot clock, teams had to determine how to get the highest percentage shot within this time period. In 2012, Brian Skinner wrote a paper entitled, “The Problem of Shot Selection in Basketball”, where he analyzed NBA data to determine if teams were shooting at the optimal point in the shot clock. Brian Skinner broke the game down to an “optimal stopping problem”, and found that teams were taking longer to shoot than the optimal equation would suggest. He found that teams were passing up high percentage shots for the chance of higher possession shots later on in the shot clock. Skinner found this strategy to be incorrect as the longer the shot clock runs, the chance for turnovers increases as the time-bounded possession limits the number of good opportunities to score. This led Skinner to make the determination that teams should strive to take the early high percentage shots in the shot clock (Skinner, 2012).

The idea of shooting earlier in the shot clock was made popular earlier than Skinner’s paper in 2012. In 2007, Mike D’Antoni, head coach of the Phoenix Suns, pushed an offensive strategy with the Suns known as “organized chaos”. D’Antoni encouraged his offense to get a good shot off within “7-seconds or less”. This team became famous for this mantra and their high scoring offense, however, their 61-win season ended short when they lost to the San Antonio Spurs in the Western Conference Semifinals. Even with this quick hitting offense, Skinner found that teams, including the 2007 Phoenix Suns, were holding onto the ball too long on offense. Skinner approximated that teams could increase their scoring by 4.5 points per game if they shot at the optimal times. This could result in approximately 10 more wins per season for NBA teams (Skinner, 2012).

Another important factor regarding offensive performance is passes per possession. Using data from the 2013 NBA season, Reuben Fischer-Baum found that the average touches per possession were around 4.25. Fischer-Baum also found that there is a negative correlation between touches and scoring efficiency, which means that, generally, as teams increase their touches, the probability of scoring decreases. Fischer-Baum also indicated that there is an “optimal” number of touches around 4.25, however, this is also heavily dependent on personnel (Fischer-Baum, 2013).

Holding onto the ball has always been discouraged in basketball offenses. Players are encouraged to pass, dribble, or shoot within 1 to 2 seconds of receiving he ball. Generally, holding onto the ball allows the defense to adjust to the ball handler (Fennelly, 2010). In the NBA, statistics from the 2014 season show that players that hold onto the ball the longest, mostly point guards, also have the lowest points per minute of possession as nine out of the top 10 worst points per minute players are point guards. Statistics also suggest that players that traditionally hold onto the ball the least, forwards and centers, have the highest points per minute (Clinchy, 2014). With this data, it can be inferred that shots taken sooner after receiving the ball will have a higher probability of success than shots taken after holding the ball for a long period of time.

According to the paper, "Quantifying Shot Quality in the NBA", the idea that catch and shoot shots are better shots statistically than shots taken off the dribble was confirmed. The EFG, or the effective field goal percentage, was higher for catch and shoot shots on every region of the court as compared to shots taken in these regions off the dribble (Chang et al, 2014).

These statistical findings will be tested and compared between the first 5 games of the Phoenix Suns 2015-2016 season, and the same games played in NBA 2K16. "NBA 2K16" is widely considered among gamers to be the most realistic basketball game due to its gameplay. According to an article comparing "NBA 2K16" to "NBA Live 2016", its main competition, "NBA 2K16" is "more realistic and rewards players who can swing the ball around… and find the open man" (Cacho, 2015). While this may be widely accepted among gamers, "NBA 2K16" will be used to determine if these statistics hold true for the video game.

The main factor in "NBA 2K16" that will determine how closely the video game models real NBA gameplay is ratings. Interestingly enough, 2K sports hired Mike Stauffer in 2014 to handle player ratings and the first game he got to work on was the 2016 version. Stauffer created mathematical formulas based on statistical measures and, for rookies, combine statistics, scouting reports, and college statistics to determine player ratings (Rappaport, 2015). The purpose of this study is to analyze how well "NBA 2K16" models the Phoenix Suns' shooting patterns compared to the real shooting patterns of the Suns during the first five games of 2015-2016.

Hypotheses

1. Shots taken in the first 8 seconds of the shot clock will have a higher probability of success than shots taken in the last 8 seconds of the shot clock.

Theoretically, the later the shot clock runs, teams will be forced to attempt shots with a low probability of success. At the beginning of the shot clock, teams are not pressured to shoot so only shots with a high probability of success will be taken. The probability of shot success at both these points in the shot clock will be compared against the "NBA 2k16" data to determine statistical differences.

2. As the shooter holds the ball longer prior to a shot, the probability of success will decrease.

As the paper, "Quantifying Shot Quality in the NBA", suggested, catch and shoot opportunities (holding onto the ball for zero seconds), will have the highest probability of success. The longer a player waits, whether this is to dribble or to attempt to find an open pass, the probability of success for any shot the player makes decreases.

3. The average passes per possession will be higher in real Suns' games than "NBA 2k16" games.

The Suns real game offense are more likely to pass the ball more due to a more structured offense and more movement away from the ball to get open. Most offensive possessions in NBA 2k16 involve less movement off the ball which would lead to less open passes available.

4. The probability distribution across the regions will be statistically different between the real NBA games, and the "NBA 2k16" games.

Both, the team and individual players will have prepared shot charts based on their performance over the first five games of the season. These shot charts will be tested against the shot charts created from the "NBA 2k16" games to determine which regions have significant differences.

5. "NBA 2k16" will allocate the correct percentage of shots to the regions.

"NBA 2k16" will correctly distribute the shots of both the players and the team to the correct region. Similarly to the fourth hypothesis, the number of shots in each region for both the team, and individual players will be tested for significant differences.

6. The real NBA games and the "NBA 2K16" games will both show a higher field goal percentage for catch and shoot shots than shots taken off the dribble in every region.

This hypothesis also revolves around the findings of the paper, "Quantifying Shot Quality in the NBA". Shot charts will be created to show the probability of success in each region for the different type of shots. The hypothesis states that there will be a statistical difference showing catch and shoot shots have a greater probability of success than shots taken off the dribble. These charts will be created for both the team, and individuals. Each region will also be tested for statistical differences with the "NBA 2k16" regions.

Data Collection

The first five games of the Phoenix Suns 2015-2016, as seen below, were recorded, or purchased from NBA.com.

- Oct. 28, 2015 - Phoenix Suns vs. Dallas Mavericks – Talking Stick Resort Arena
- Oct. 30, 2015 - Phoenix Suns vs. Portland Trailblazers – Talking Stick Resort Arena
- Oct. 31, 2015 – Phoenix Suns at Portland Trailblazers – Moda Center
- Nov. 2, 2015 – Phoenix Suns at Los Angeles Clippers – Staples Center
- Nov. 2, 2015 – Phoenix Suns vs. Sacramento Kings – Talking Stick Resort Arena

Each shot in these games by the Phoenix Suns was logged with the following information:

- Shot
- Shooter
- Passes prior to shot on possession
- Time on the shot clock when shot was taken
- Time shooter held ball before shooting
- Region the shooter received the ball
- Region the shooter took the shot
- Whether the pass was off the pass, off the dribble, or off the rebound
- Result of the shot (successful or unsuccessful)

Each possession was watched twice to ensure correct data. Every player on the Suns' roster during the first five games of the season was numbered in order to complete this log. The numbers, players, and their jersey numbers are listed below:

1. Eric Bledsoe - #2
2. Brandon Knight - #3
3. P.J. Tucker - #17
4. Markieff Morris - #11
5. Tyson Chandler - #4
6. Ronnie Price - #14
7. Sonny Weems - #10
8. T.J. Warren - #12
9. Jon Leuer - #30
10. Alex Len - #21
11. Archie Goodwin - #20
12. Devin Booker - #1
13. Mirza Teletovic - #35

The court was divided into 7 regions in order to log the area of the court where the shots came from. The figure below illustrates the region breakdown that was used.

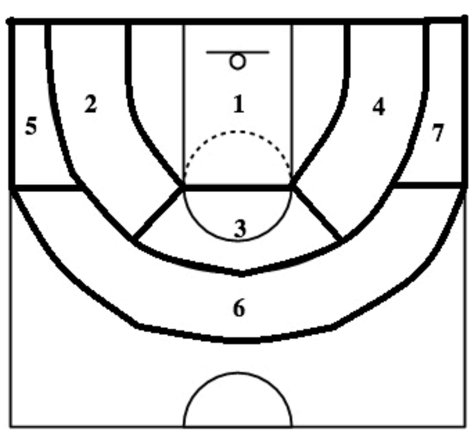

Figure 1: Region Breakdown for NBA Court

The same games that were listed above were watched on NBA 2K16. In order to watch the game, the games were set up in "Play Now" mode without a user-controlled team. This allowed the game to be played between computer programmed users or "CPUs". In the same way the real games were logged, the Phoenix Suns' shots during the NBA 2K16 game were logged.

In order to get the most accurate player data for the game, roster updates were applied to ensure the most up to date NBA 2K16 player ratings. This allowed NBA 2K16 to adjust their player rankings to more accurately represent their play. The roster update used was the update that occurred on December 12, 2015. These updated rankings are listed below:

1. Eric Bledsoe - 86
2. Brandon Knight - 84
3. P.J. Tucker - 73
4. Markieff Morris - 75
5. Tyson Chandler - 79
6. Ronnie Price - 70
7. Sonny Weems - 69
8. T.J. Warren - 75
9. Jon Leuer - 74
10. Alex Len - 75
11. Archie Goodwin - 70
12. Devin Booker - 72
13. Mirza Teletovic - 75

Statistical Tests

Throughout the final analysis, multiple statistical tests are used. These tests include a two-sample test for equality of proportions, a Welch two sample t-test, a Mann-Whitney-Wilcoxon test, a generalized linear model, and a Chi-squared goodness of fit test.

Two-Sample Test for Equality of Proportions

In this test, two population proportions can be tested to determine if the proportions are equal. For this test, the null hypothesis states that the two proportions are equal.

$$H_0: p_1 = p_2$$

The alternative hypothesis states that the two proportions are not equivalent to each other.

$$H_A: p_1 \neq p_2$$

In order to complete the test, the test statistic, Z, must be calculated. In this case, the test statistic can be represented by the following equation (Comparing, 2016):

$$Z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

In this equation, $\hat{p}_1$ represents the sample proportion for the first population while $\hat{p}_2$ is the sample proportion for the second population. The number of trials for the first population and second population are represented by n_1 and n_2, respectively. Lastly, $\hat{p}$ represents the proportion of successes in the two samples combined. This is represented by the following equation:

$$\hat{p} = \frac{Y_1 + Y_2}{n_1 + n_2}$$

In this equation, Y_1 and Y_2 represent the number of successes in the first population and second population, respectively.

Once the test statistic has been calculated, a Z table can be used to determine the p-value. In the case of an alternative hypothesis with the first proportion not being equal to the second proportion, a two-tail test has to be used. This is important as the p-value is equal to twice the probability found on the Z table. For this paper, a 99% confidence interval was used in all of the statistical tests. For the two-sample test for equality of proportions, this means that the p-value must be less than the alpha value, 0.01, in order for the null hypothesis to be rejected.

Welch Two Sample T-Test

In order to use the Welch two sample t-test, the two populations are assumed independent and that they follow a normal distribution. Assuming a normal population allows the test to compare means, as seen in the null hypothesis and alternative hypothesis below.

$$H_0: \mu_1 = \mu_2$$

The null hypothesis states that the mean of the first population, μ_1, is equal to the mean of the second population, μ_2. The alternative hypothesis can either state that the mean of the first population is not equal, greater, or less than the mean of the second population. In this case, the alternative hypothesis will state that the mean of the first population is greater than the mean of the second population.

$$H_A: \mu_1 > \mu_2$$

In order to test these hypotheses, the test statistic, as well as the degrees of freedom have to be calculated. In this case, the test statistic is t and can be represented by the following equation (Darnold):

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

In this test, $\bar{X}_1$ and $\bar{X}_2$ represent the average of the first population and second population, respectively. Similarly, $s_1$and s_2 represent the sample variances for the first population and second population, respectively. After the test statistic has been calculated, the degrees of freedom must be calculated in order to use the t tables to find the p-value. The degrees of freedom, df, can be calculated using the following equation (Darnold):

$$df = \frac{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)^2}{\frac{\left(\frac{\sigma_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{\sigma_2^2}{n_2}\right)^2}{n_2 - 1}}$$

Similarly to $s_1$and s_2, $\sigma_1$and σ_2 represent the variances for each population assuming a normal distribution. This degree of freedom value is used with the test statistic and the t tables to find the p-value for a one-tail test. If this p-value is less than the alpha value of 0.01, the null hypothesis can be rejected

Mann-Whitney-Wilcoxon Test

The Mann-Whitney-Wilcoxon test is a nonparametric test where the data do not follow a normal distribution. This is unlike the Welch two sample t-test as the data does not follow a normal distribution, and medians are compared instead of means. In this case, the null hypothesis states that the medians are equal, while the alternative hypothesis states that the medians are not equal. This can be seen in the equations below.

$$H_0: B_1 = B_2$$

$$H_A: B_1 \neq B_2$$

First, the data between the two samples are combined and ranked, smallest to largest. These ranks are then used in the following equation to calculate the value, C (McCarthy, 2009).

$$C = n_1 n_2 + n_2 \frac{(n_2 + 1)}{2} - \sum R_i$$

In this equation, n_1 is the total trials for the larger sample, and n_2 is the total trails for the smaller sample. The ranks are summed up for each population and the smallest number is known as the smaller sample. Also in this equation, R_i is the summed up ranks of the smaller sample. After this value is obtained, the C statistic is used to calculate the following equation (McCarthy, 2009):

$$n_1 n_2 - C$$

Whichever value is larger, either the C value or the $n_1 n_2 - C$ value, becomes the U value. When there are over 20 trials between the samples, which in this paper will be true, the U value approximates the t-value, or the test statistic (McCarthy, 2009). This will allow the t-tables to be used to find the p-value. If this value is less than or equal to 0.01, the null hypothesis can be rejected.

Generalized Linear Model

A generalized linear model is a broad term that encompasses a wide range of models. For this paper, a logistic regression model will be used, as the results were logged as a binary variable. The model can be represented using the following equations (Binary, 2016).

$$logit(\pi_i) = log\left(\frac{\pi_i}{1-\pi_i}\right)$$

$$logit(\pi_i) = \beta_0 + \beta_1 x_i$$

While the betas represent coefficients based off the variable, pi represents the probability of success at values of the explanatory variable. β_0 is the y-intercept and if β_1 is positive, it will indicate that the probability of success increases as the explanatory variable increases. In order to determine how well the data follow the model, the Chi-squared goodness of fit test, which is explained in more detail in the following section, can be used to determine a p-value. Again, a 99% confidence level will be used to determine if the data follows the model.

Chi-squared Goodness of Fit Test

The Chi-squared goodness of fit test compares population data to a given set of proportions or a certain distribution. In this paper, the real Suns' games data represents the given set of proportions that the proportions from the "NBA 2k16" Suns' games will be compared against. In this test, the null hypothesis states that the data is consistent with the specified distribution, while the alternative hypothesis states that the data is not consistent with the specified distribution.

The test statistic in this case, Chi-squared, is calculated using the following equation (Chi-Square):

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

In this equation, O_i represents the observed frequency and E_i is the expected frequency count. The expected frequency count is represented with the following equation (Chi-Square):

$$E_i = np_i$$

In this equation, n is the total sample size and p_i is the hypothesized proportion of observations. The last equation that is important for the Chi-squared goodness of fit test is the degrees of freedom equation (Chi-Square).

$$df = k - 1$$

In this equation, k is the number of levels of the categorical variable. With the χ^2 value and degrees of freedom, the p-value can be obtained from the χ^2 table. Similar to the other tests, a 99% confidence level was used so the p-value must be less than or equal to 0.01 to reject the null hypothesis.

Results

Shot Clock

The hypothesis that the probability of success for shots taken in the first eight seconds of the shot clock will be higher than the last eight seconds of the shot clock was tested and the results were analyzed in Table 1 below.

Table 1: Probability of Success During the First and Last 8 Seconds of the Shot Clock

	First 8 Seconds of the Shot Clock	Last 8 Seconds of the Shot Clock
Real Suns' Games	0.58	0.37
Suns "NBA 2K16" Games	0.67	0.42

Using a two-sample test for equality of proportions, the probability of success for shots taken in the first eight seconds of the shot clock was statistically greater than the probability of success for shots taken in the last eight seconds of the shot clock for real Suns' games. Using a 99% confidence interval, the p-value was 0.0002875. Similarly, the probability of success for shots taken in the first eight seconds of the shot clock was statistically greater than the probability of success for shots taken in the last eight seconds of the shot clock. Using a 99% confidence interval, the p-value was 0.0002875.

These proportions were compared against their real or video game counterpart using the same two-sample test for equality of proportions. At 99% confidence, the probability of success for shots taken in the first eight seconds of the shot clock were not statistically different between the real and "NBA 2K16" games as the p-value was 0.2614. The same was found to be true for the last eight seconds of the shot clock as the p-value was found to be 0.5274.

Passes Per Possession

The results of the hypothesis that real Suns' games will have a higher number of passes per possession than "NBA 2K16" games are seen in Table 2 below.

Table 2: Average Number of Passes per Possession for Both Game Types	
	Average number of passes per possession
Real Suns' Games	2.004
Suns "NBA 2k16" Games	2.230

Using a Welch two sample t-test, the "NBA 2K16" data was found to have a higher average number of passes per possession than the real Suns' games. Using a 99% confidence interval, the p-value was found to be 0.004438.

Another method was used to analyze this hypothesis. The average number of passes for an unsuccessful and successful event were compared against each other using the same statistical test. Table 3 below consolidated the average number of passes for a successful and unsuccessful attempt.

Table 3: Average Number of Passes per Possession For An Unsuccessful/Successful Attempt		
	Unsuccessful Attempt	Successful Attempt
Real Suns' Games	2.065	1.940
Suns "NBA 2k16" Games	2.532	2.031

Using the Welch two sample t-test to analyze the real Suns' games, the average number of passes for a successful attempt was determined not to be greater statistically when compared to the average number of passes for a successful attempt at a confidence level of 99%. The p-value for this test was found to be 0.2012. Using the same test to analyze the "NBA 2k16" games, the average number of passes for an unsuccessful shot was determined to be statistically greater than the average number of passes for a successful shot at 99% confidence level. The p-value for this test was 0.001332.

When the real Suns' games were compared to the "NBA 2k16", the average number of passes for an unsuccessful attempt were found to be statistically different between the two options at a 99% confidence level. The p-value was found to be 0.002622. When the average number of passes for a successful attempt was tested between the real and "NBA 2k16" games, there was no statistical significant difference between the two at 99% confidence level. The p-value was found to be 0.5712.

Histograms were created for each game type and result to analyze the distribution. Figure 2 below presents the histogram for passes per possession in the "NBA 2k16" Suns' games that led to a successful shot.

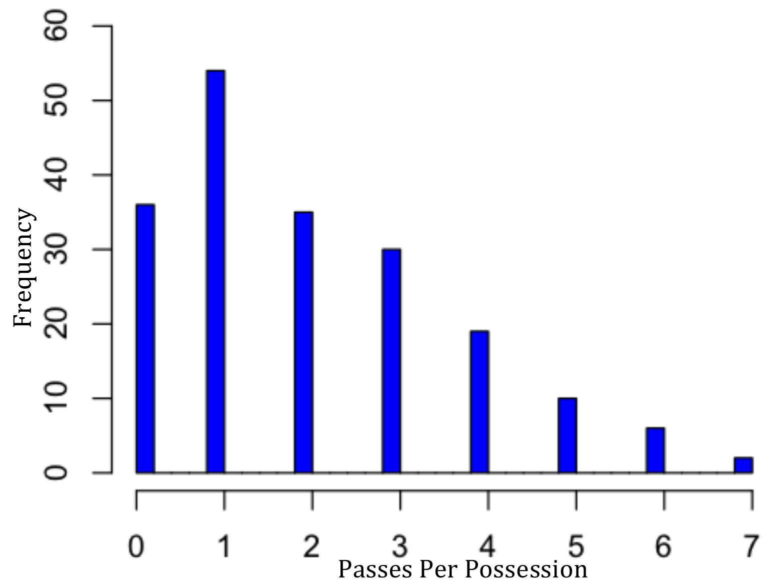

Figure 2: Histogram of the Passes per Possession in "NBA 2k16" Suns' Games for Successful Shots

Similarly, the histogram below presents a histogram for passes per possession in the "NBA 2k16" Suns' games that led to a successful shot.

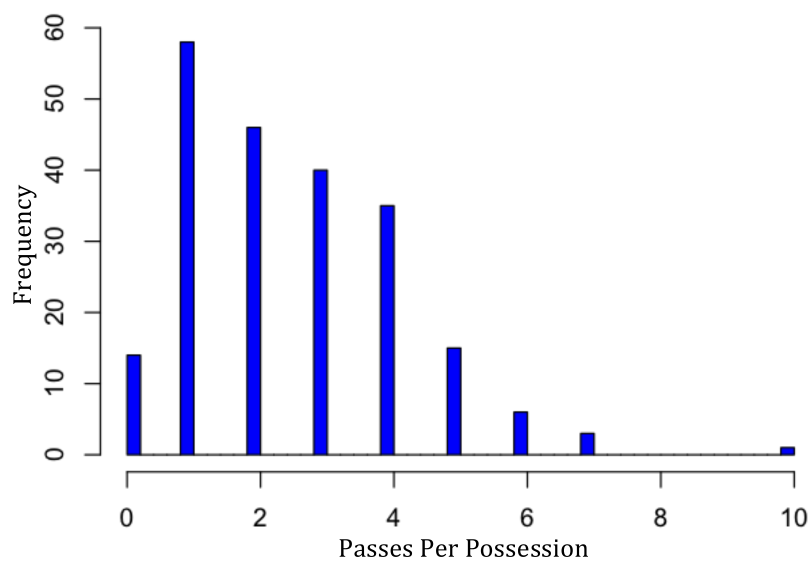

Figure 3: Histogram of the Passes per Possession in "NBA 2k16" Suns' Games for Unsuccessful Shots

The same histograms were created for the real Suns' games on the following page.

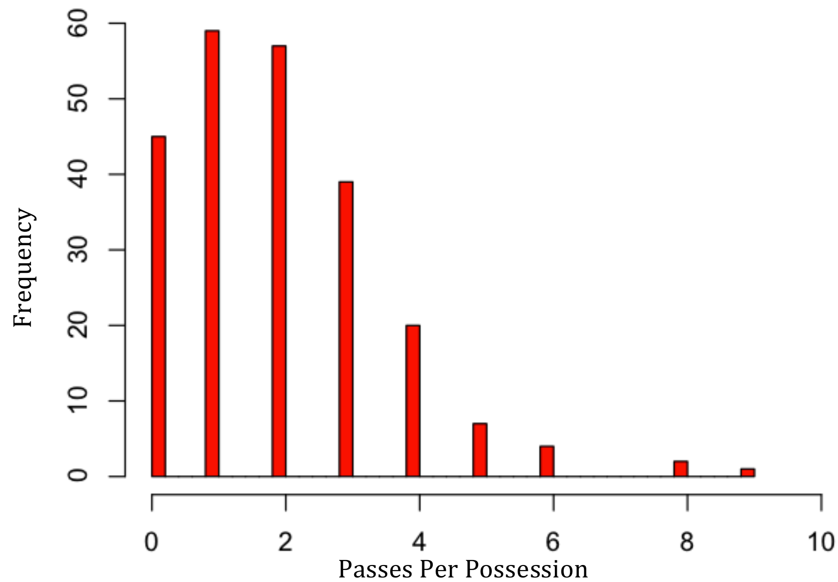

Figure 4: Histogram of the Passes per Possession in Real Suns' Games for Successful Shots

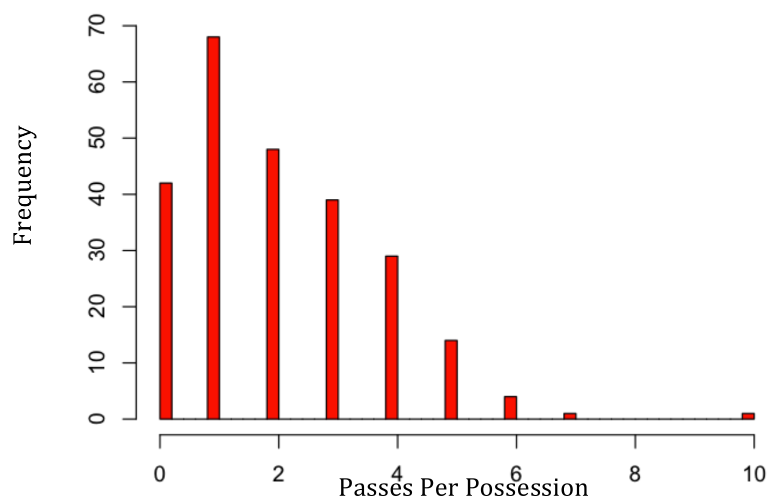

Figure 5: Histogram of the Passes per Possession in Real Suns' Games for Unsuccessful Shots

All of the histograms show a skewed right distribution, indicating that the Welch two sample t-test wasn't the best test for this comparison. Due to the skewed right distribution, the Mann-Whitney-Wilcoxon test was used to compare medians between the game types.

Table 4 below consolidates p-value for the Mann-Whitney-Wilcoxon test for both game types.

Table 4: Analysis of the Effect of the Number of Passes in a Possession on the Shot Outcome Using the Mann-Whitney-Wilcoxon Test	
Game Type	p-value
"NBA 2k16" Suns' Games	0.001041
Real Suns' Games	0.4092

Based on the p-values, only the "NBA 2k16" Suns' games had a significant finding using the Mann-Whitney-Wilcoxon test. This means that the population medians for number of passes for an unsuccessful shot and the number of passes for a successful shot, are significantly different in the "NBA 2k16" data. The high p-value for real Suns' games indicates that the population medians are not significantly different and the null hypothesis that the population medians are equal can not be rejected.

Allocation of Shots

The hypothesis regarding the allocation of shots was analyzed below. First, Table 5 consolidated the proportion of team shots that each player took for each game type.

Table 5: Proportion of Team Shots Taken for Individual Players in Both Game Types		
Player	Real Suns' Games	"NBA 2k16" Suns' Games
1. Bledsoe	0.20*	0.17*
2. Knight	0.18*	0.23*
3. Tucker	0.05*	0.05*
4. Morris	0.15*	0.09*
5. Chandler	0.07*	0.10*
6. Price	0.04*	0.02
7. Weems	0.02	0.09*
8. Warren	0.11*	0.11*
9. Leuer	0.06*	0.02
10. Len	0.07*	0.03
11. Goodwin	0.02	0
12. Booker	0.03	0
13. Teletovic	0.03	0.09*

The Chi-squared goodness of fit test was used to test the null hypothesis that the allocation of shots in the "NBA 2k16" Suns' games were equal to the proportion of shots each player took in the real Suns' games. The p-value for this test was found to be less than 2.2e-16 indicating that there is strong evidence against the null hypothesis. Therefore, it can be concluded that the shots were not allocated correctly in the "NBA 2k16" Suns' games.

The asterisks in Table 5 indicate that at least 15 shots were taken. The players that received at least 15 shots in both game types were analyzed using a two sample test for equality of proportions to determine if there was a significant difference between the proportion of their shots in both game types. Table 6 consolidates this information below.

Table 6: Analysis of Proportion of Team Shots for Each Game Type	
Players	P-value
1. Bledsoe	0.2940
2. Knight	0.0648
3. Tucker	0.7027
4. Morris	0.01162
5. Chandler	0.2309
8. Warren	1.000

As the p-values indicate, the null hypothesis, the proportion of the team shots each player took was equal for each game type, can not be rejected for any of the players. This means that there is no statistically difference between the shots allocated in real Suns' games and "NBA 2k16" Suns' games for the players in Table X above. This implies that the difference in the proportion of team shots lies with the role players, Price, Weems, Leuer, Len, Goodwin, Booker, and Teletovic.

Similarly, the allocation of player's shots based on regions was analyzed. Due to the low number of shots for members not in the starting five, only the starting five were analyzed. Table 7 below shows the proportion of shots each starting five member took in each region during real Suns' games.

Table 7: Proportion of Player's Shots Taken in Each Region in Real Suns' Games							
Players	1	2	3	4	5	6	7
1. Bledsoe	0.49*	0.07	0.09	0.14	0.02	0.18*	0
2. Knight	0.30*	0.12	0.05	0.15	0.04	0.30*	0.04
3. Tucker	0.45	0	0	0	0.18	0.05	0.32
4. Morris	0.46*	0.15	0.03	0.10	0	0.24*	0.01
5. Chandler	0.94*	0	0.03	0	0	0	0

Table 8 below shows the proportion of shots each starting five member took in each region during "NBA 2k16" Suns' games.

Table 8: Proportion of Player's Shots Taken in Each Region in "NBA 2k16" Suns' Games							
Players	1	2	3	4	5	6	7
1. Bledsoe	0.65*	0.09	0.09	0.06	0.01	0.09	0.01
2. Knight	0.35*	0.10	0.03	0.12	0.01	0.37*	0
3. Tucker	0.41	0.18	0	0.14	0.05	0.18	0.05
4. Morris	0.35	0.05	0	0.08	0	0.51*	0
5. Chandler	1.00*	0	0	0	0	0	0

First, a Chi-squared goodness of fit test was used for each player to determine if each players shots were allocated correctly in the "NBA 2k16" Suns' games. Table 9 below consolidates the p-values for this test for each player.

Table 9: Analysis of the Chi-Squared Goodness of Fit Test for Allocation of Shots Across the Seven Regions for Individual Players	
Player	P-value
Bledsoe	<2.23-16
Knight	0.1659
Tucker	NA
Morris	NA
Chandler	0.2709

Based on the findings in Table 9, only Bledsoe's allocation of shots across the seven regions had strong evidence to reject the null hypothesis. This means that Bledsoe's shot allocation across the seven regions in the "NBA 2k16" Suns' games is not equivalent to his allocation of shots in the real Suns' games. In the case of Tucker and Morris, a p-value could not be computed due to the number of regions with 0 shots taken so the results are inconclusive.

Further comparing the allocation of shots, the remaining regions that have at least 15 shots were analyzed for players where the null hypothesis could not be rejected. Table 10 consolidates the results below.

Table 10: Analysis of the Allocation of Shots for Individual Players Across Regions		
Player	Region	P-value
Bledsoe	1	0.06485
Morris	6	0.003996

As the p-values show, the null hypothesis could only be rejected for Morris' region 6. "NBA 2k16" allocated too many shots for Markieff Morris in region 6 due to its p-value of 0.003996. For every other region, the null hypothesis that the proportion of shots allocated to the regions between game types are equal could not be rejected.

Table 11 below compares the proportion of shots taken in each region for the entire team between the two game types.

Table 11: Proportion of Team Shots Taken in Each Region for Both Game Types		
Region	Real Suns' Game	"NBA 2k16" Suns' Game
1	0.51*	0.44*
2	0.09*	0.11*
3	0.05*	0.03
4	0.09*	0.10*
5	0.04*	0.03
6	0.18*	0.28*
7	0.04*	0.01

First, a chi-squared goodness of fit test was run in order to test the null hypothesis that the proportion of shots taken in each region were equal between the game types. The p-value was found to be 1.227e-06, indicating that there is strong evidence to reject the null hypothesis. The regions with at least 15 shots were compared using a two sample test for equality of proportions in Table 12 below.

Table 12: Analysis of the Allocation of Shots for Entire Team Across Regions	
Region	P-value
1	0.02236
2	0.3167
4	0.6987
6	0.0006842

For regions 1, 2, and 4, the null hypothesis, the proportion of shots allocated to a region is equal between the two game types, could not be rejected. In region 6, the null hypothesis could be rejected, meaning the Suns took a significantly greater number of shots in region 6 in “NBA 2k16” games than in real Suns’ games.

Time Held Onto Ball Before Shot

The hypothesis that the probability of success for a shot decreases as the player holds onto the ball longer was tested using a generalized linear model. Table 13 below summarizes the p-value and slope found for each game type.

Table 13: Analysis of General Linearized Model for the Time Player Holds onto Ball Before Shooting		
Game Type	p-value	Slope
“NBA 2k16” Suns’ Games	0.001021	0.05336
Real Suns’ Games	5.07e-05	0.06374

The p-values for both game types reject the null hypothesis that the time a player holds onto the ball before shooting has no effect on the probability of success. The positive slopes indicate that there is in fact an increased probability of success as the player holds onto the ball before shooting. This disproves the hypothesis.

Probability Distribution – Regions

The hypothesis that the probability distribution across the regions would be different between the two game types was tested and the results are consolidated below. Table 14 shows the probability of success for each starting player across the 7 regions in the “NBA 2k16” games.

Table 14: Probability of Success in “NBA 2k16” Suns’ Games Across the 7 Regions							
Players	1	2	3	4	5	6	7
1. Bledsoe	0.60*	0.50	0.50	0.50	0	0.50	0
2. Knight	0.52*	0.56	1.00	0.36	0	0.35*	0
3. Tucker	0.67	0.25	0	0.67	1.00	0.25	1.00
4. Morris	0.46	0	0	0.33	0	0.37*	0
5. Chandler	0.53*	0	0	0	0	0	0

Table 15 below compiles the same proportions for real Suns' games.

Table 15: Probability of Success in Real Suns' Games Across the 7 Regions							
Players	1	2	3	4	5	6	7
1. Bledsoe	0.60*	0.57	0.44	0.46	0	0.29*	0
2. Knight	0.60*	0.50	0.25	0.23	0.33	0.40*	0.33
3. Tucker	0.70	0	0	0	0	1.00	0.57
4. Morris	0.48*	0.09	0.50	0.14	0	0.35*	0
5. Chandler	0.76*	0	0	0	0	0	0

Before any analysis was completed, shot charts were created for Eric Bledsoe, a point guard, and Tyson Chandler, a center, to illustrate the differences between the game types and positions. Figure 6 below shows Eric Bledsoe's "hot/cold zones".

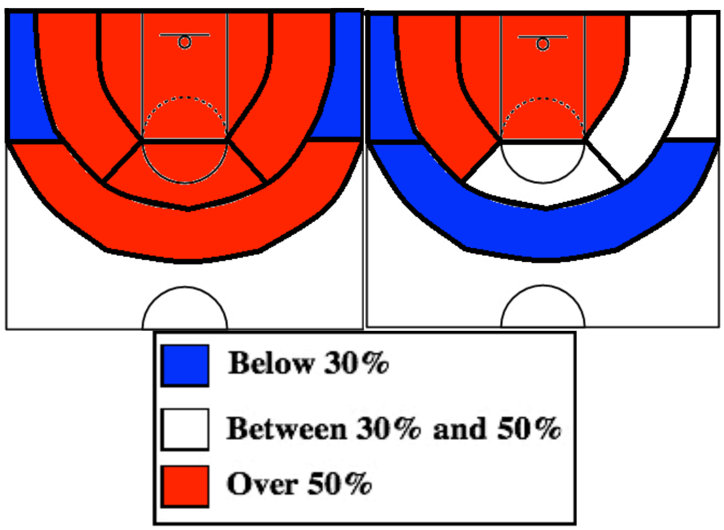

Figure 6: A Comparison of Eric Bledsoe's Shot Chart Between Game Types. On the Left is the Shot Chart for the "NBA 2k16" Suns' Games and the Real Suns' Games are on the Right.

Although the shot charts are not perfect, they illustrate a similar trend. In real Suns' games, Eric Bledsoe shot well in two point regions and poorly in the three point regions. In the "NBA 2k16" Suns' games, Bledsoe shot extremely well from two-point range and poorly from the corner three point shots. The main difference occurs at the three point shot at the top of the key where Bledsoe shot poorly in real Suns' games but great in "NBA 2k16" games. Figure 7 below shows Tyson Chandler's "hot/cold zones".

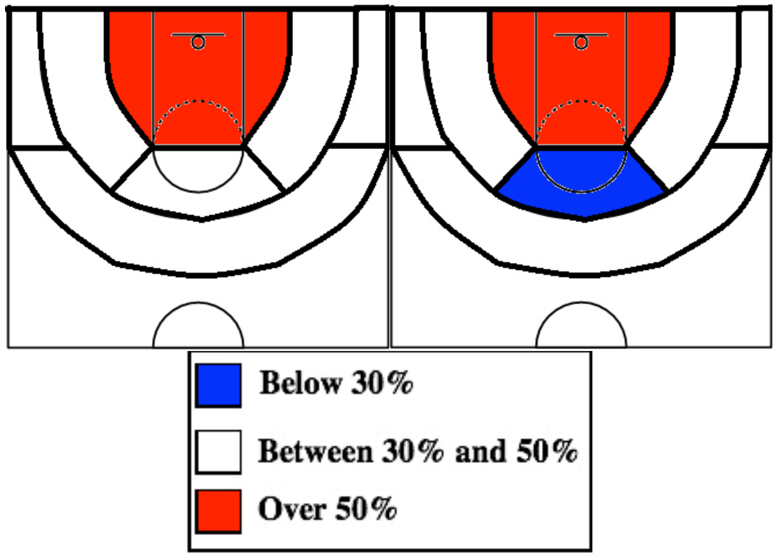

Figure 7: A Comparison of Tyson Chandler's Shot Chart Between Game Types. On the Left is the Shot Chart for the "NBA 2k16" Suns' Games and the Real Suns' Games are on the Right.

Similarly to Eric Bledsoe, Tyson Chandler's shot chart in the "NBA 2k16" Suns' games is very close to the shot chart from the real Suns' games. As a center, he has the highest probability of success close to the basket. The main difference lies in region 3. In the "NBA 2k16" Suns' games, Chandler did not shoot in any other region besides the one closest to the basket, while in real Suns' games, he took one shot and missed from region 3. When these charts are compared with Eric Bledsoe, it is clear that point guards have the ability to shoot from anywhere on the court, while Tyson Chandler is most comfortable from only one region.

In tables 14 and 15, proportions where at least 15 shots were taken were marked with an asterisk. Since at least 15 shots were needed to test statistical significance, an asterisk in the same region for each player was required. These regions are listed below:

- 1. Bledsoe: Region 1
- 2. Knight: Region 1 and Region 6
- 4. Morris: Region 6
- 5. Chandler: Region 1

These regions were tested to determine statistical significance using the two-sample test for equality of proportions. The resulting p-values are consolidated in Table 16 below.

Table 16: Analysis of Significant Differences For Regions		
Player	Region	P-value
Bledsoe	1	1.000
Knight	1	0.7063
Knight	6	0.9228
Morris	6	1.000
Chandler	1	0.07107

As the p-values show, none of these regions provide a p-value less than or equal to the alpha of 0.01. This means that the null hypothesis can not be rejected in any of these regions, meaning there is no significant difference between the real Suns' games proportions, and the "NBA 2k16" proportions for these regions. Table X below analyzes the same hypothesis for the whole team, instead of just individual players.

Table 17: Probability of Success Across the 7 Regions for Both Game Types		
Region	Real Suns' Games	"NBA 2k16" Suns' Games
1	0.63*	0.56*
2	0.29*	0.42*
3	0.50*	0.50
4	0.27*	0.41*
5	0.18*	0.33
6	0.38*	0.37*
7	0.50*	0.60

Each proportion was marked with an asterisk if at least 15 shots were taken in the regions as a team. Regions 3, 5, and 7 could not be compared, as there were not enough shots taken in these regions in the "NBA 2k16" games. Regions 1, 2, 4, and 6 are analyzed in Table X below using the two-sample test for equality of proportions.

Table 18: Analysis of Significant Differences for Entire Team Across the Regions	
Regions	P-value
1	0.2424
2	0.2694
4	0.2689
6	1.000

As the p-values show for the four regions analyzed, the null hypothesis could not be rejected in any case. This means that the probability of success in these regions are not statistically different for the Suns in real life and in "NBA 2k16". Shot charts were created in Figure 8 below to illustrate the differences in the "hot/cold zones" between the game types.

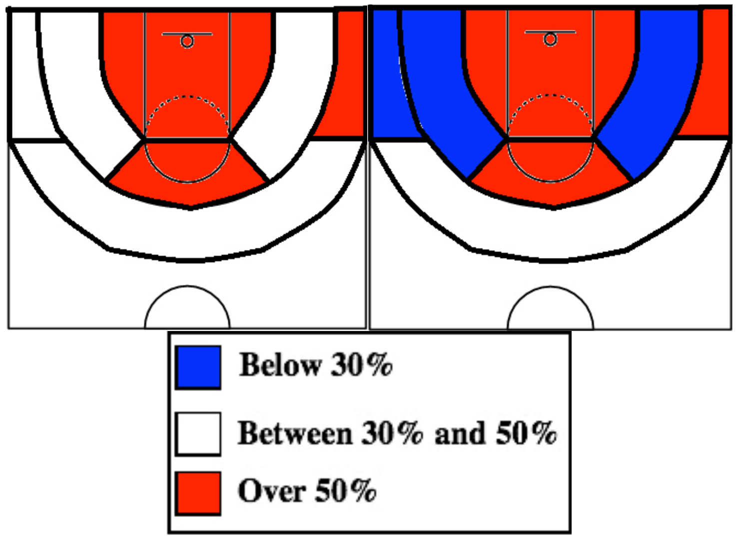

Figure 8: Shot Charts with "Hot/Cold Zones" for Both Game Types. On the left side are "NBA 2k16" Suns' Games, while Real Suns' Games are on the Right.

The game correctly modeled zones 1, 3, and 7 as hot zones, and region 6 as neutral, however, zones 2, 4, and 5 were cold zones in the real Suns' games, while they were neutral in the "NBA 2k16" Suns' games.

Shot Type

The hypothesis that stated that catch and shoot shots will have a higher probability of success than shots taken off the dribble. Table 19 below shows the probability of success for catch and shoot and off the dribble shots in real games.

Table 19: Probability of Success for Catch and Shoot Shots and Off the Dribble Shots in Real Suns' Games

Player	Catch and Shoot	Off the Dribble
1. Bledsoe	0.35*	0.52*
2. Knight	0.42*	0.41*
3. Tucker	0.50*	0.60
4. Morris	0.32*	0.31*
5. Chandler	0.74*	0
6. Price	0.50	0.67
7. Weems	0.25	0.50
8. Warren	0.57*	0.40*
9. Leuer	0.61*	0.56
10. Len	0.69	0.27*
11. Goodwin	0.67	0.71
12. Booker	0.71	0.80
13. Teletovic	0.20	0

In order to compare the proportions between the two shot types, both types needed at least 15 shots. Bledsoe, Knight, Morris, and Warren were the only players that could be analyzed in Table 20 below using the two-sample test for equality of proportions.

Table 20: Analysis of Significant Differences for Shot Types for Individual Players in Real Suns' Games	
Players	P-value
Bledsoe	0.8353
Knight	0.5000
Morris	0.5000
Warren	0.1961

As Table 20 shows, the null hypothesis that the probability of success for catch and shoot shots and off the dribble shots are equal could not be rejected for any of the players with enough shots for each shot type. The same analysis was completed below for the "NBA 2k16" games.

Table 21 below shows the probability of success for shot types in the "NBA 2k16" Suns' games.

Table 21: Probability of Success for Catch and Shoot Shots and Off the Dribble Shots in "NBA 2k16" Suns' Games		
Player	Catch and Shoot	Off the Dribble
1. Bledsoe	0.50*	0.57*
2. Knight	0.36*	0.51*
3. Tucker	0.73	0.30
4. Morris	0.42*	0.20
5. Chandler	0.43*	0
6. Price	0	0.50
7. Weems	0.57*	0.47*
8. Warren	0.34*	0.40
9. Leuer	0.60	0.50
10. Len	0.60	1.00
11. Goodwin	0	0
12. Booker	0	0
13. Teletovic	0.40*	0

As Table 21 shows above, Bledsoe, Knight, and Weems are the only players with enough shots for each shot type to analyze using the two-sample test for equality of proportions. The analysis is consolidated in Table 22 below.

Table 22: Analysis of Significant Differences for Shot Types for Individual Players in "NBA 2k16" Suns' Games	
Players	P-value
Bledsoe	0.5709
Knight	0.9014
Weems	0.3965

Based on the p-values presented in Table 22 above, the null hypothesis that there is no difference between the probability of success for the shot types can not be rejected. This means that catch and shoot shots for the "NBA 2k16" games do not have a statistically greater probability of success than shots taken off the dribble.

The probability of success for shot types for the Suns are compared between game types in Table 23 below.

Table 23: Probability of Success for Different Shot Types in Both Game Types		
	Catch and Shoot	Off the Dribble
Real Suns' Games	0.51	0.45
"NBA 2k16" Suns' Games	0.43	0.48

Using the two-sample test for equality of proportions, the probability of success for catch and shoot shots was compared to the probability of success for shots taken off the dribble. In real Suns' games, the null hypothesis that the proportions are equal could not be rejected as the p-value was found to be 0.1653. Similarly, the null hypothesis could not be rejected in the "NBA 2k16" Suns' games as the p-value was found to be 0.8419.

Discussion

Shot Clock

In real Suns' games, the probability of success for a shot taken in the first eight seconds of the shot clock was 0.58, while the probability of success for a shot taken in the last eight seconds of the shot clock was 0.37. As the results section stated, this provided a statistically significant result indicating that shots taken in the first eight seconds of the shot clock have a higher probability of success than shots taken in the last eight seconds of the shot clock. This result was consistent with the findings of "The Problem of Shot Selection in Basketball", which concluded that shots should be taken sooner in the shot clock to have the highest chance of success.

In the "NBA 2k16" Suns' games, the probability of success for a shot taken in the first eight seconds of the shot clock was 0.67, while the probability of success for a shot taken in the last eight seconds of the shot clock was 0.42. Using a two-sample test for equality of proportions, these results were found to be statistically significant as the probability of success in the first eight seconds of the shot clock was greater than the probability of success in the last eight seconds of the shot clock. Once again, the data collected in "NBA 2k16" followed the literature findings. With these results, the hypothesis was proven correct.

In order to examine differences between the "NBA 2k16" Suns' games and the real Suns' games, the probability of success in the first eight seconds of the shot clock was statistically analyzed against each other. The same process was completed for the probability of success in the last eight seconds of the shot clock. The high p-values found in both cases indicate that there was no statistically significant difference between the proportions. The data from the "NBA 2k16" Suns' game showed the same trend as the data from real Suns' games and literature findings, while they're probability of success at both ranges of the shot clock was found to not be statistically different than the probability of success at both ranges of the shot clock in real Suns' games. This means that "NBA 2k16" correctly showed the effect that the shot clock had on the Suns' shots during the first five games of the season.

Passes Per Possession

The hypothesis that real Suns' game would have a higher average passes per possession was found to be incorrect. Real Suns' games had an average of 2.004 passes per possession, while "NBA 2k16" Suns' games had an average of 2.230 passes per possession. Using a Welch two sample t-test, it was determined that this finding was statistically significant as the "NBA 2k16" Suns actually had more passes per possession. The Suns actually had higher frequencies at 0 passes per possession and 2 passes per possession. The likely reasoning for this statistic is due in large part to how long shooting possessions lasted for each game type. The Suns in the real game shot with an average of 13.34 seconds left on the shot clock while the Suns in "NBA 2k16" shot with an average of 10.43 seconds. On average, the Suns in "NBA 2k16" were holding on to the ball about three seconds longer which could explain the extra passes per possession. Another possible explanation for this finding is that fastbreaks were very rare in "NBA 2k16". Since fastbreaks normally take very little time to run with very few passes, the Suns in the real game had more occurrences of possessions with few passes.

The passes per possession data was also used to determine if there the number of passes per possession had any effect on a shot being successful or unsuccessful. In real Suns' games, the average passes per possession for an unsuccessful shot were 2.065, while the average passes per possession for a successful result were 1.940. Using the Welch two sample t-test, these findings were not found to be statistically significant. In the "NBA 2k16" Suns' games, the average passes per possession for an unsuccessful shot were 2.532, while the average passes per possession for a successful result were 2.031. Using the same statistical test, these findings were found to be statistically different, indicating that the more passes per possession, the higher the probability of an unsuccessful attempt in the "NBA 2k16" Suns' games. This finding was tested using the Mann-Whitney-Wilcoxon statistical test to determine if the two populations for each game type, number of passes for an unsuccessful shot and the number of passes for a successful shot, are different. As the p-values indicate, the populations in the "NBA 2k16" Suns' games were found to be statistically different, while the populations in the real Suns' games were not found to have a statistical difference. This follows the finding in the Welch two sample t-test which indicated there was a significant difference in the number of passes per possession for an unsuccessful shot compared to the number of passes per possession for a successful shot in the "NBA2k16" Suns' games, but not in the real Suns' games.

The number of passes for each result were tested between the game types to determine if there were any statistically significant results. For unsuccessful attempts, the passes per possession were found to be significantly greater in the "NBA 2k16" games than the real games. For successful attempts, there were no significant differences. These results indicated that the Suns in "NBA 2k16" were more likely to miss a shot as the number of passes in the possession increased, while this trend was not observed in real Suns' games. This follows Fischer-Baun's findings that there is a negative correlation between touches, which are essentially passes minus one, and scoring efficiency. Again, it is important to point out that this correlation is heavily dependent on personnel so it may not be true for all teams.

Time Held Onto Ball Before Shot and Shot Type

The hypothesis that the probability of success for a shot will decrease as a player holds onto the ball longer was proven untrue. In fact, both game types support the conclusion that the probability of success increases for the Suns as the time a player holds onto the ball before the shot increases. This was against expected results from literature.

Similarly, the hypothesis that catch and shoot shots would have a higher probability of success was proven untrue. This comparison was analyzed for individual players, the entire team, and across regions and there was no evidence to indicate a difference between the probabilities of success. This finding is against basketball teachings as generally a catch and shoot shot is considered the best shot, however, other factors could influence the results for both of these hypotheses.

First, contested shots are likely the most important factor in the probability of success of the shot. While catch and shoot shots usually indicate an open look at the basket, factors such as previous touches on the ball could play an important role. If a player is coming off the bench cold or hasn't gotten many touches in the game, holding onto the ball longer may provide the player with more of a feel and more confidence shooting. Also, players consistently receive the ball at the three point line and drive to the basket to give the best look at the basket. This could explain why the probability of success increased as a player holds onto the ball longer and there was no statistical difference between shots taken off the dribble and shots taken off of a pass.

Shot Allocation

The hypothesis that "NBA 2k16" would not allocate the Suns' shots correctly for players or the entire team was proven to be correct. The distribution of shots for individual players was significantly different between the "NBA 2k16" Suns' game and the real Suns' games. Interestingly enough, the players that play the most in the Suns lineup, the starting five and T.J. Warren did not have evidence of a significant difference in their percentage of team shots between the game types. This means that the difference lies with the remaining players Ronnie Price, Sonny Weems, Mirza Teletovic, Jon Leuer, Devin Booker, Archie Goodwin, and Alex Len. In Devin Booker and Archie Goodwin's case, they did not even play in the "NBA 2k16" Suns' games. This difference could be part of the strong evidence against the null hypothesis.

While Devin Booker and Archie Goodwin clearly were not allocated enough playing time in the "NBA 2k16" Suns' games, there may be other interpretations to explain this difference. In the case of Mirza Teletovic, and Alex Len, offseason additions and extenuating circumstances could explain this difference. Mirza Teletovic, known as a pure shooter, missed the second half of last season with the Nets recovering from blood clots in his lung. Due to this, his minutes at the start of the year were down as he was playing in an NBA basketball game for the first time in a year. Additionally, this was his first year as a Phoenix Sun. The lack of previous experience with the Suns and the uncertainty of how he would return from the blood clots would make modeling his shooting tendencies understandably difficult. This may be the reason "NBA 2k16" had him taking about 10% of the Suns' shots, while he only took 3% in the real Suns' games. In Alex Len's case, the Suns made a major offseason addition by signing Tyson Chandler to a $52 million dollar contract. Due to this addition, Alex Len was relegated to a bench role which could explain the low number of shots Alex Len received in "NBA 2k16" compared to real Suns' games. In real Suns' games, he shot 7% of the team's shots while he only shot 3% in "NBA 2k16". The other players that could explain the differences in shot allocations between the games types, Ronnie Price, Jon Leuer, and Sonny Weems, were all new additions to the Suns team, which could explain these significant differences between the video game and real NBA games.

Due to the relatively small number of shots for bench players, only the starting five's shots across regions were analyzed. Using the Chi-squared goodness of fit test, only Eric Bledsoe's shot allocations across the regions were found to be statistically different between the game types. Additionally, there was evidence indicating a difference between Markieff Morris' percentage of shots taken in region 6. In "NBA 2k16", 90% of Eric Bledsoe's shots were two point shots, while only 79% were two point shots in the real Suns' games. This indicates that Bledsoe is modeled with the tendency to drive to the basket or shoot two point jumpers in "NBA 2k16", which varies from the data in the first five games of the Suns' 2015-2016 season. In contrast, Markieff Morris shot 51% of his shots from region 6 in the "NBA 2k16" Suns' game which was significantly more than the 24% he shot in real Suns' games. Interestingly enough, only one player was found to have a statistically different distribution between the regions. On top of this, only one additional region was found to be statistically different indicating that the modeling of the Suns' starting five was fairly consistent in "NBA 2k16" when compared to real Suns' games.

As a team, the allocation of shots between regions was found to be statistically different between the game types. The Chi-squared goodness of fit test indicated there was strong evidence that the shots were not allocated correctly across the seven regions in "NBA 2k16" when compared to the real games. Only region 6 in the "NBA 2k16" Suns' games was found to have evidence indicating a significantly different allocation of shots than in the real Suns' games. Additionally, real Suns' games had at least 15 shots taken in every region, while this wasn't the case in regions 3, 5, and 7 in "NBA 2k16", which received an inordinately small number of shots. Together, this paints an interesting picture seen in the figure below.

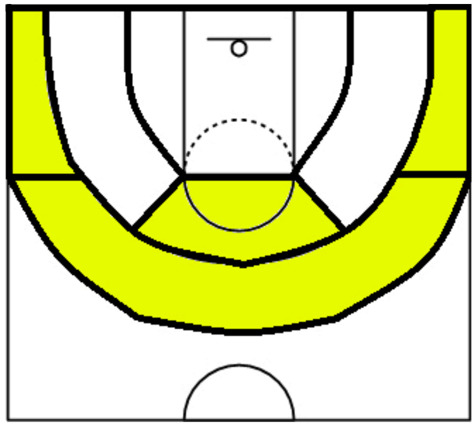

Figure 9: A Shot Chart Indicating the Main Differences Between the Game Types

First, the corner three pointers, regions 5 and 7, did not have a large number of attempts over the 5 game stretch for the entire team, while three pointers from the top of the key were taken significantly more than the real Suns' games. One interpretation could indicate that "NBA 2k16" has trouble modeling corner three pointers. With the player automation, it is hard to keep players behind the line for three pointers in the video game. The space between the three-point line and sideline is very small in real games, however, players are conscious of their footing for three pointers in that region. In "NBA 2k16" shots are taken without the players really worrying about whether their foot is behind the line. In the two point region, only two pointers from the top of key were found to be taken significantly less than in real Suns' games. This indicates that "NBA 2k16" models the Suns' tendency to take three pointers from the top of the key and two pointers from the wings or close to the basket.

Probability Distribution – Regions

The hypothesis at the probability of success across the regions would be different between the game types could not be proven. Interestingly enough, the starting five did not have any evidence of statistical differences. Only five regions had 15 shots taken in both game types, so these were the only regions that could be statistically compared. Additionally, the probability of success across regions for the entire team was analyzed. As discussed earlier, regions 3, 5, and 7 did not have at least 15 shots, but the other regions were compared using the two-sample test for equality of proportions. No evidence was found to reject the null hypothesis so there is no evidence that "NBA 2k16" incorrectly modeled the Suns' and their players' probability of success across the regions. In order to further analyze all of the regions, all of the regions would have to have 15 shots so more games would have to be logged.

Interestingly enough, Figure X illustrating the "hot/cold zones" for both game types show some interesting differences although statistical differences were not found. Regions 1, 3, and 7 had a probability of success of 50% or higher for both game types. For the real Suns' games, regions 2, 4, and 5 were cold zones with under 30% probability of success. In the "NBA 2k16" Suns' games, all of the other regions were neutral with no region having less than a 30% probability of success. While no statistical significance was found, the game correctly modeled the Suns' best regions.

Conclusion

Overall, the results of this paper indicate that Mike Stauffer and the rest of the "NBA 2k16" development team modeled the Phoenix Suns very closely for the first five games of the season. Although it was against what was hypothesized and literature findings, the Suns had a higher probability of success the longer a player held onto the ball in both game types. The game also correctly modeled the effect of different shots on the probability of success as no evidence was found to indicate this was a significant factor in real games as well as "NBA 2k16". Additionally, "NBA 2k16" correctly modeled the Suns having a higher probability of success in the first eight seconds of the shot clock than the last eight seconds of the shot clock, which followed published statistical findings. Lastly, there was no evidence indicating that the probability of success in the seven regions for "NBA 2k16" was different than the real Suns' games

There were some differences between the real Suns' games and the "NBA 2k16" Suns' games. The average number of passes per possession was significantly greater in the "NBA 2k16" game. Also, "NBA 2k16" showed that unsuccessful shots had a significantly greater number of passes per possession than successful shots. Although this wasn't present in the real Suns' games, this follows literature findings. Lastly, the proportion of team shots individual players took was significantly different between the game types. The findings of this paper indicate that the gameplay of "NBA 2k16" is consistent with statistical findings, and models the Suns' and their players very well.

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