Kawhi Leonard's Impact on the Toronto Raptors' 2019 Playoff Run as a Markov Chain

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Introduction

Basketball is a team sport invented by Canadian physician Dr. James Naismith in 1891 (Zarum, 2010). The sport has evolved immensely since its creation, including the implementation of new rules and various leagues around the world. The National Basketball Association, or, NBA, is the world's most prestigious league. NBA rules dictate that 12 active players may attend games for each team, with five players on the court at all times for each team. Points are scored by throwing a round ball into a hoop suspended ten feet above a hardwood court. Players compete for four twelve-minute quarters, at which point the team with more points wins. Ties are solved by playing an additional five-minute overtime period until a winner is found. Currently, 82 regular season games are played by all 30 NBA franchises; teams are seeded in relation to how many wins they receive. The top eight teams in both the eastern and western conferences make the playoffs. All four playoff rounds are decided by a seven-game series following the same rules as the regular season. The winner of the two teams, one eastern conference team and one western, who meet in the NBA finals, is awarded the Larry O'Brien Trophy and the title of World Champion. While basketball is a team sport, high caliber players often make huge impacts on team success. In an article for sports media website Bleacher Report, the difficult task superstar lacking teams face is detailed. It is stated that only two teams, the 1979 Seattle Supersonics and the 2004 Detroit Pistons, in the modern era of the NBA, have won a championship without a superstar on their roster (Knepper, 2017). Due to their impact, all-star caliber players are highly sought after through blockbuster trades or expensive free agent signings.

Basketball Terminology

In order to fully understand the analysis performed, it is necessary to define terms frequently used when discussing basketball. A rebound occurs when a shot is missed, and the ball is then secured by a player. If the player who grabs the rebound is on the offensive team the play is referred to as an offensive rebound. Similarly, if the rebounding player is on the defensive team, they have recorded a defensive rebound. When one team loses the ball to the other, this is called a turnover. The player who takes the ball from the opposing team is credited with a steal, while the player who loses the ball receives a turnover. There are three different ways a player can score points: three points can be scored from making a shot behind the three-point line, two points from making a shot inside the three-point line and lastly, one point from making a free throw. A free throw is a set shot from the free throw line which is awarded to a player if they are in the process of taking a shot while an opposing player breaks the rules, or fouls, them. If the shot was missed the player takes an equal number of free throws to the point value of the shot. For example, a foul on a missed two-point shot will result in two free throws for a total possible of two points. If the player is fouled but manages to make the shot despite the infraction, they

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receive one free throw for a chance at an extra point. Lastly, a defensive stop occurs when the defending team manages to prevent the opposing team from scoring and secures possession of the ball.

The Raptors and Kawhi Leonard

In the summer of 2018, the Toronto Raptors made a trade that would change their franchise history forever. After making the playoffs for four straight seasons starting in 2014 but failing to advance to the championship series, Raptors' general manager Masai Ujiri executed a blockbuster trade that sent shockwaves throughout the entire NBA. Then franchise cornerstone for the past nine seasons DeMar DeRozan, alongside up-and-coming rookie Jakob Poeltl and a draft pick, were dealt to the San Antonio Spurs in exchange for one of the NBA's premier all around superstars, Kawhi Leonard, and three-point specialist Danny Green. However, this trade did not go unscathed by criticism; many analysts and fans alike were disappointed in the organization for seemingly giving up on DeRozan for a chance at short term success. NBA insider for Yahoo sports, Chris Haynes, even went as far as to tweet, "Kawhi Leonard has no desire to play in Toronto" implying that Leonard may refuse to play until he is traded out of Toronto (Haynes, 2018). Looking back on the trade at the end of the 2018-2019 playoffs, which saw the Raptors advance to and win their first NBA championship in franchise history, this initial skepticism is all but forgotten.

Kawhi had a post season for the history books; he became one of only three players in the last ten years to have fourteen thirty-point games in a single playoff run (Bowers, 2019). He also managed to leap to third in Raptors career playoff points scored, only behind Kyle Lowry and DeMar DeRozan. who played in six and five playoff runs respectively, in comparison to Kawhi's one (Zarum & Grange, 2019). It was immediately evident to fans and analysts alike that Leonard was largely the reason Toronto became NBA Champions. As stated by sports writer Dan Devine of the Ringer, "The Raptors won Game 5 … in large part because, when it mattered most, they had Kawhi Leonard, the best player on the court, in this series, in the conference, and maybe, at this moment in time, in the whole goddamn league" (Zarum, Zwelling, & Grange, 2019). In order to justify whether Kawhi Leonard's contributions to the Raptors allowed them to win an NBA title, data was collected from play by play descriptions of the entire Raptors playoff run provided on the official NBA website (NBA.com, 2019). Data on sequences of events that occurred throughout the game was manually collected and separated into when Kawhi was on the court as opposed to when he was resting. Transition probabilities for all defined transitions were calculated using this data. These transition probabilities were then used to create two Markov chains to analyze the differences in the Raptors performance, with and without their superstar. The purpose of this analysis is to gather an insight into the impact that Leonard actually had on the team's success. He is known as an all-around superstar and primarily an elite defender, therefore, initial areas of curiosity are if the Raptors were able to have more defensive stops, make more shots and commit fewer turnovers with him in the game.

The Markov Chains

The two Markov chains being studied have an identical, finite, state space. The thirteen states are as follows: shoot 2, shoot 3, shoot ft, miss 2, make 2, miss 3, make 3, miss ft, make ft, offensive rebound, defensive stop, no defensive stop and turnover. Please note that in the naming of the states 2, 3, and ft, correspond to two-point field goals, three-point field goals, and free throws respectively. The initial distribution is not crucial; however, the game could begin in any of the following states: shoot 2, shoot 3, defensive stop, no defensive stop or turnover. In figures 1 and 2, arrows colored green represent transitions with probability greater than or equal to 0.5; arrows colored red represent transitions with probability less than or equal to 0.15.

Kawhi In

Figure 1. Transition Diagram for when Kawhi Leonard is on the Court

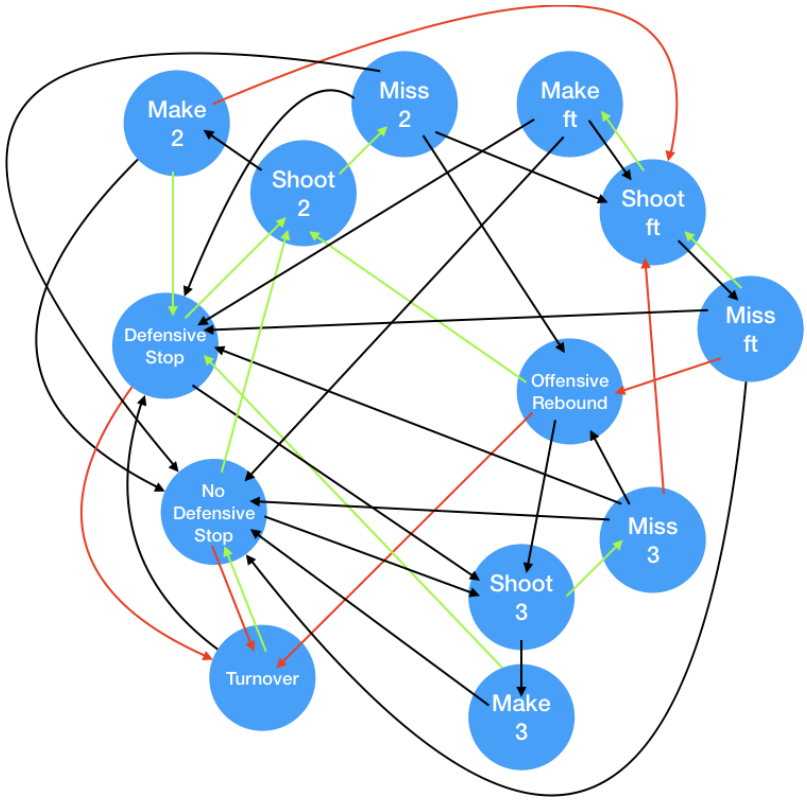


Table 1. Transition Matrix for when Kawhi Leonard is on the Court

##	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
## shoot 2	0.00	0.00	0.00	0.57	0.43	0.00	0.00
## shoot 3	0.00	0.00	0.00	0.00	0.00	0.65	0.35
## shoot ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
## miss 2	0.00	0.00	0.31	0.00	0.00	0.00	0.00
## make 2	0.00	0.00	0.09	0.00	0.00	0.00	0.00
## miss 3	0.00	0.00	0.02	0.00	0.00	0.00	0.00
## make 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
## miss ft	0.00	0.00	0.51	0.00	0.00	0.00	0.00
## make ft	0.00	0.00	0.44	0.00	0.00	0.00	0.00
## offensive rebound	0.61	0.29	0.00	0.00	0.00	0.00	0.00
## defensive stop	0.55	0.34	0.00	0.00	0.00	0.00	0.00
## no defensive stop	0.57	0.31	0.00	0.00	0.00	0.00	0.00
## turnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00

##	miss ft	make ft	offensive rebound	defensive stop
## shoot 2	0.00	0.00	0.00	0.00
## shoot 3	0.00	0.00	0.00	0.00
## shoot ft	0.17	0.83	0.00	0.00
## miss 2	0.00	0.00	0.20	0.23
## make 2	0.00	0.00	0.00	0.50
## miss 3	0.00	0.00	0.21	0.38
## make 3	0.00	0.00	0.00	0.59
## miss ft	0.00	0.00	0.12	0.21
## make ft	0.00	0.00	0.00	0.31
## offensive rebound	0.00	0.00	0.00	0.00
## defensive stop	0.00	0.00	0.00	0.00
## no defensive stop	0.00	0.00	0.00	0.00
## turnover	0.00	0.00	0.00	0.46

##	no defensive stop	turnover
## shoot 2	0.00	0.00
## shoot 3	0.00	0.00
## shoot ft	0.00	0.00
## miss 2	0.26	0.00
## make 2	0.41	0.00
## miss 3	0.39	0.00
## make 3	0.41	0.00
## miss ft	0.17	0.00
## make ft	0.25	0.00
## offensive rebound	0.00	0.09
## defensive stop	0.00	0.11
## no defensive stop	0.00	0.12
## turnover	0.54	0.00

As seen in Table 1, the transitions with probability above 0.5 in decreasing order are: shoot ft to make ft (0.83), shoot 3 to miss 3 (0.65), offensive rebound to shoot 2 (0.61), make 3 to defensive stop (0.59), no defensive stop to shoot 2 (0.57), shoot 2 to miss 2 (0.57), defensive

stop 8 to shoot 2 (0.55), turnover to no defensive stop (0.54), miss ft to shoot ft (0.51) and make 2 to defensive stop (0.50). A successful team would like to see high probabilities in all of these transitions except shoot 3 to miss 3, shoot 2 to miss 2, and turnover to no defensive stop. However, in the NBA season in question, all 30 teams on average shot 35.5% on three-point shots and 52.0% on two-point shots (Basketball Reference). Taking these league wide averages into account, it is acceptable to see the Raptors shoot 35% from three. The seemingly below average two-point shooting (43%) is likely explained by the method of data collection. Official NBA statistics do not count missed shots if the shooter is fouled and gets to shoot free throws. In collecting the data, misses were recorded regardless of fouls in order to study the transitions between missing shots and shooting free throws.

The transitions with probability below 0.15 in decreasing order are: miss ft to offensive rebound (0.12), no defensive stop to turnover (0.12), defensive stop to turnover (0.11), offensive rebound to turnover (0.09), make 2 to shoot ft (0.09), and miss 3 to shoot ft (0.02). A team would desire all of these transitions to be low except for make 2 to shoot ft and miss 3 to shoot ft, however since these transitions are rare events, these low probabilities are acceptable.

Kawhi Out

Figure 2. Transition Diagram for when Kawhi Leonard is not on the Court

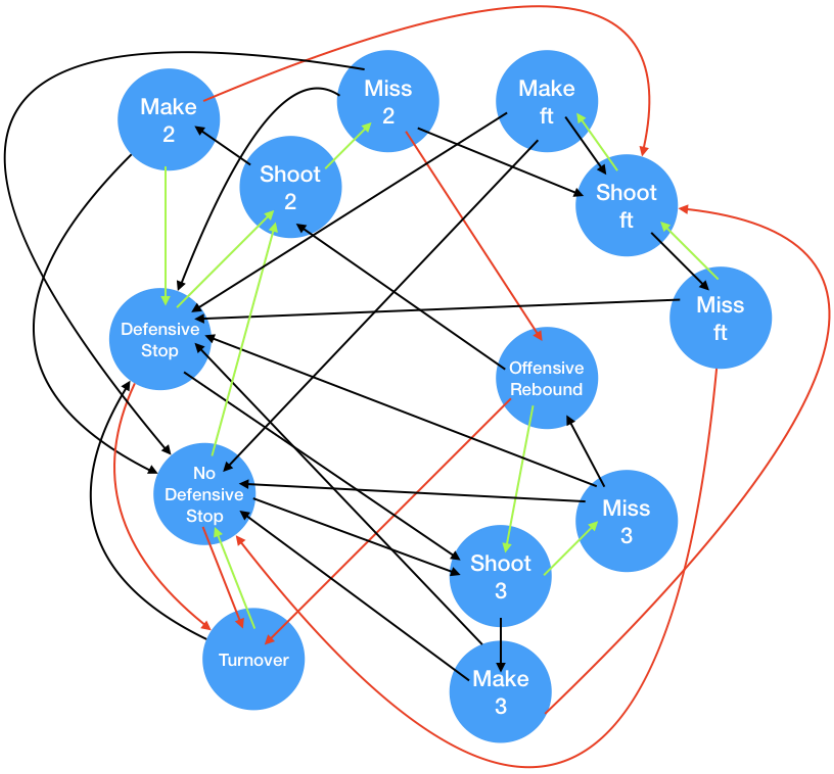


Table 2. Transition Matrix for when Kawhi Leonard is not on the Court

##	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
## shoot 2	0.00	0.00	0.00	0.59	0.41	0.00	0.00
## shoot 3	0.00	0.00	0.00	0.00	0.00	0.66	0.34
## shoot ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00
## miss 2	0.00	0.00	0.19	0.00	0.00	0.00	0.00
## make 2	0.00	0.00	0.05	0.00	0.00	0.00	0.00
## miss 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
## make 3	0.00	0.00	0.05	0.00	0.00	0.00	0.00
## miss ft	0.00	0.00	0.62	0.00	0.00	0.00	0.00
## make ft	0.00	0.00	0.41	0.00	0.00	0.00	0.00
## offensive rebound	0.39	0.58	0.00	0.00	0.00	0.00	0.00
## defensive stop	0.52	0.35	0.00	0.00	0.00	0.00	0.00
## no defensive stop	0.59	0.35	0.00	0.00	0.00	0.00	0.00
## turnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00

##	miss ft	make ft	offensive	rebound	defensive	stop
## shoot 2	0.00	0.00		0.00		0.00
## shoot 3	0.00	0.00		0.00		0.00
## shoot ft	0.19	0.81		0.00		0.00
## miss 2	0.00	0.00		0.12		0.32
## make 2	0.00	0.00		0.00		0.50
## miss 3	0.00	0.00		0.16		0.49
## make 3	0.00	0.00		0.00		0.48
## miss ft	0.00	0.00		0.00		0.23
## make ft	0.00	0.00		0.00		0.33
## offensive rebound	0.00	0.00		0.00		0.00
## defensive stop	0.00	0.00		0.00		0.00
## no defensive stop	0.00	0.00		0.00		0.00
## turnover	0.00	0.00		0.00		0.39

##	no defensive stop	turnover
## shoot 2	0.00	0.00
## shoot 3	0.00	0.00
## shoot ft	0.00	0.00
## miss 2	0.37	0.00
## make 2	0.45	0.00
## miss 3	0.35	0.00
## make 3	0.48	0.00
## miss ft	0.15	0.00
## make ft	0.26	0.00
## offensive rebound	0.00	0.03
## defensive stop	0.00	0.13
## no defensive stop	0.00	0.06
## turnover	0.61	0.00

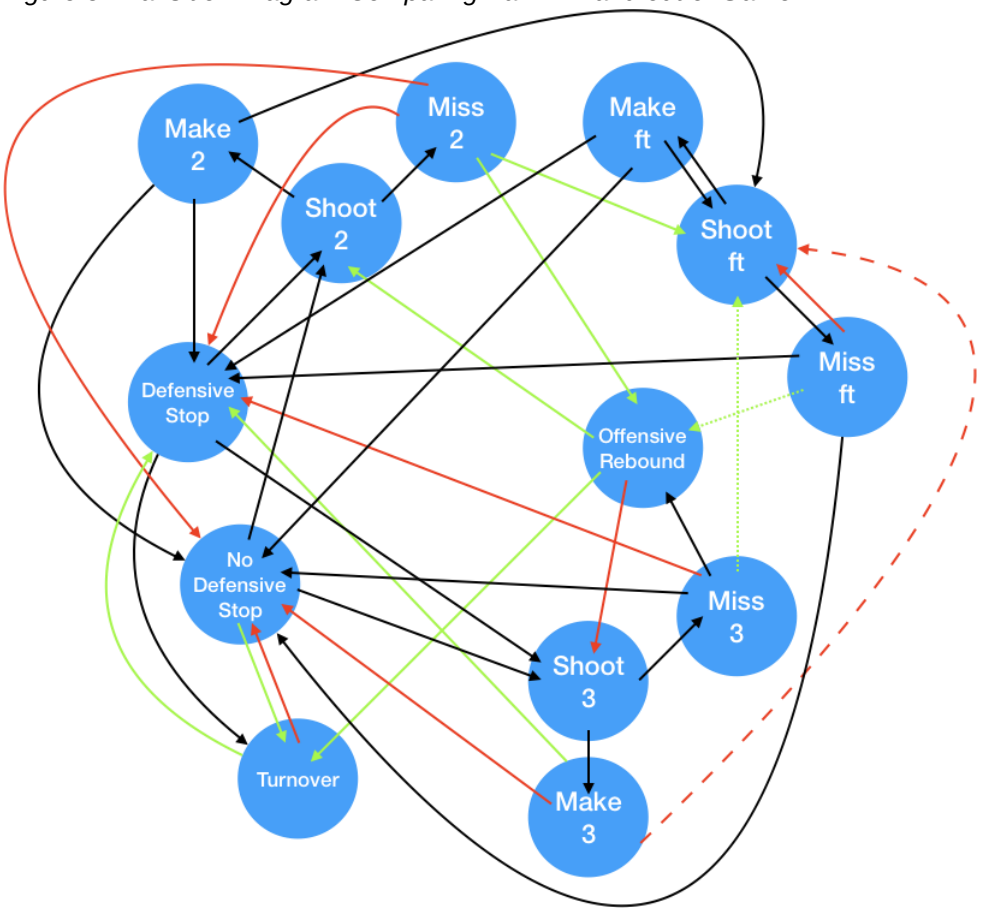
Taken from Table 2, transitions with probability above 0.5 in decreasing order are: shoot ft to make ft (0.81), shoot 3 to miss 3 (0.66), miss ft to shoot ft (0.62), turnover to no defensive stop

(0.61), no defensive stop to shoot 2 (0.59), shoot 2 to miss 2 (0.59), offensive rebound to shoot 3 (0.58), defensive stop to shoot 2 (0.52), and make 2 to defensive stop (0.50). These are the same transitions seen when Kawhi was playing, aside from make 3 to defensive stop and offensive rebound to shoot 2. Once again, a similar interpretation of these highly probable transitions holds.

Similarities and Differences

In order to visualize the similarities and differences between the two transition diagrams, refer to Table 3. Green arrows represent transitions that were at least 0.05 greater in probability when Kawhi was in the game; red arrows represent transitions that were at least 0.05 greater in probability when he is resting. Black arrows are transition probabilities within plus or minus 0.05 of each other in both cases. Small dashed lines are transitions only observed when Kawhi played; large dashed lines are transitions only observed when he rested.

Figure 3. Transition Diagram Comparing Kawhi in and out of Game



The transition matrices and diagrams differ in that when Kawhi plays, transitions from miss 3 to shoot ft and miss ft to offensive rebound exist while, when he is not on the court, a

transition from make 3 to shoot ft exists. The probabilities of these events are very small: 0.02, 0.12 and 0.05 respectively. Both chains are similar, although, from the color coding of the diagrams, some differences can be noticed. When Leonard is not active, the majority of transitions leading out of the state offensive rebound are into the state shoot 3. When he plays, the majority of these transitions lead to shoot 2. It is also interesting that after making a two or three point shot with Kawhi active, the chain transitioned to getting a defensive stop more often than not. When he is not active, this observation is true for two-point shots, but not threes.

Results

The Markov chains in question are irreducible because all of the states communicate. This conclusion is evident from the diagram as well, provided by R. The chains are also aperiodic. Since the chains are both irreducible and aperiodic, they can be described as regular Markov chains. Furthermore, all states are recurrent and belong to the same class which is an immediate conclusion drawn from irreducibility.

Stationary Distribution

Table 3. Stationary Distributions of Markov Chains

##	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3
## Kawhi In	0.1692324	0.09613506	0.06817912	0.09575935	0.07347301	0.06288534
## Kawhi Out	0.1692556	0.11608680	0.04301232	0.09910787	0.07014778	0.07668764

##	make 3	miss ft	make ft	offensive rebound
## Kawhi In	0.03324972	0.01177891	0.05640021	0.03350371
## Kawhi Out	0.03939916	0.00810377	0.03490855	0.02413998

##	defensive stop	no defensive stop	turnover
## Kawhi In	0.1382117	0.1274218	0.03376975
## Kawhi Out	0.1486425	0.1415340	0.02897401

It is interesting to note that as seen in Table 3, while Kawhi was on the court, the proportion of time the chain spends in the states shoot ft, make 2, miss ft, make ft, offensive rebound, and turnover is higher than when he is resting. Also, while he was on the court, the proportion of time spent in shoot 3, miss 2, miss 3, make 3, defensive stop and no defensive stop is lower than when he is resting. From these observations, one would expect that while Kawhi was on the court, the Raptors shoot a similar number of twos while missing less and making more, shoot less threes while making and missing less, and shoot more free throws while both missing and making more. It can also be expected that more offensive rebounds and turnovers will be observed due to Kawhi's presence. As hypothesized, the long run proportion of time spent in no defensive stop is lower when Leonard is in the game. The most peculiar observation is in relation to defensive stops. As previously mentioned, Kawhi is one of the NBA's elite defenders and in turn, one would expect to see more defensive stops when he is on the court. Contrary to this assumption, the chain spends more time in defensive stop when he is resting. A possible explanation for this is that Kawhi is often tasked with guarding the opposing team's most potent offensive threat, so his rest periods usually coincide with the player he is guarding's rest periods. This could potentially result in a stronger offensive opponent when he is in the game.

Per Game Interpretation

The small values from the stationary distribution are hard to interpret on a per-game basis; in order to deal with this issue, another set of vectors was found. On average in the games sampled there were 347.125 transitions; by multiplying the stationary distribution by the average number of transitions, the set of vectors obtained will represent the expected number of times each state is visited per game, grouped by Leonard's participation. These vectors are shown in Table 4.

Table 4. Expected Number of Visits to Each State Per Game

	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
Kawhi In	58.74478	33.37088	23.66668	33.24046	25.50432	21.82907	11.54181
Kawhi Out	58.75287	40.29663	14.93065	34.40282	24.35005	26.62020	13.67643

	miss ft	make ft	offensive rebound	defensive stop
Kawhi In	4.088755	19.57792	11.629976	47.97672
Kawhi Out	2.813021	12.11763	8.379589	51.59754

	no defensive stop	turnover
Kawhi In	44.23129	11.72232
Kawhi Out	49.12997	10.05760

From this matrix it was found that the average number of points scored if Kawhi were to play the whole game is 105.212. If he were to sit out an entire game, the chain suggests that the team would score on average 101.847 points. Therefore, his presence accounts for approximately
3.4 more points per game. The team did score more points from three with Kawhi out, which can be attributed to his offensive play style which is largely focused on getting to the rim or scoring from midrange. This play style also explains the increased number of free throw shots as well as free throws made during his playing time. It is also noticeable that his presence contributes to an increased number of offensive rebounds (approximately 3.3 more), which are particularly valuable in the playoffs when extra chances are at a premium due to the heightened level of
defense. As eluded to previously, it is also seen that on average when he is off the court, approximately 3.6 more defensive stops are observed.

Mean First Passage Time

The mean first passage time matrices (Tables 7 and 8 in appendix) were also calculated via R. In order to better visualize the differences between these two matrices, a matrix (Table 9 in appendix) was constructed taking the mean first passage time when Kawhi was playing and subtracting the mean first passage time when he was not playing. Positive entries in this matrix can be interpreted as transitions that give a specific starting state (denoted by matrix row); it took a longer time to visit a specific state (denoted by matrix column) when Kawhi was on the court. Negative entries are states where this transition took less time when he was playing. Interestingly, transitions into the state turnover took less time regardless of starting state when Kawhi was active. This is a conclusion that is supported by previous results that more turnovers were observed when he played. Contrary to the initial hypothesis, the expected time to return to

the state defensive stop was longer when he was active, however, this difference was small (0.51) steps. The largest differences seen in this matrix were in relation to mean first passage time into miss ft and make ft. Regardless of starting state, all of these entries were negative, and therefore, the expected time to visit these two states is faster when Kawhi is playing. This is likely due to the increased number of visits to the state shoot ft, and in turn also to states make ft and miss ft, as seen in Table 4.

Simulations

Using the Markov chain package in R, a simulation of both chains was made for 10000 transitions. The transition matrices are nearly identical to the matrices of the chains simulated from. To view these simulated matrices, please refer to the appendix.

Discussion

Limitations

It is important to note that Kawhi Leonard is an important player and consequently plays far more minutes than he sits. This was represented in the data collected, as the chain with him on the court was built with 6895 total transitions whereas the chain with him resting only had 1436, approximately one-fifth of the transitions. Additionally, the minutes that he sits out are sometimes when the game has already been decided, for example, if the Raptors are trailing or leading by twenty points with three minutes remaining in a game. These factors may cause Kawhi's impact to appear different than it truly was.

Future Work

In order to have an even amount of transitions in both chains, regular season games could also be used. In the regular season Kawhi only played in 60 games, sitting the remaining 22; perhaps gathering data from these 22 games will provide a better baseline to study Kawhi's effect. Another alternative is to gather data from the entire regular season and playoffs. However, in doing so, the chains will likely once again be drastically unequal in number of transitions as Kawhi plays the large majority of minutes in games he is active.

Conclusion

As hypothesized, Kawhi Leonard's presence on the basketball court for the Raptors during their 2019 playoff run was largely beneficial. On average the team scored more points from two-point shots and free throws, as well as in total. They also secured more offensive rebounds and had less possessions that ended in not getting a defensive stop. Contrary to expectation, Kawhi's lineup turned the ball over more often and had fewer defensive stops. As mentioned previously, these surprises may be attributed to Leonard's increased playing time as well as his obligation to guard the opposing team's strongest offensive threat.

This method for analyzing a player's individual impact can be used league-wide in order to determine which players should play in specific situations. With more data, the idea can be extended to specific five-player lineups. The ensuing Markov chain could be used to judge performance as well as chemistry, which is impossible to measure tangibly. This way, teams will be able to find their best combination of players who play well as a unit rather than as a team of

individuals. The Markov chains discussed are not limited to NBA players but, rather, could be applied at any level where relevant statistics are tracked including, but not limited to, NCAA, CIS or EuroLeague. It is also important to notice that specific Markov chains can be designed to fit teams' needs. For example, the Markov chains studied did not focus on types of defensive stops (steals, blocks, missed shots), types of points conceded (conceded three-point shot, conceded two-point shot, conceded free throw) or how other game events such as timeouts, technical fouls, or flagrant fouls affect the result of games. By expanding the chain to include these statistics, some interesting results would come in the form of difference in points scored and conceded and rebounding, block and steal differentials. In conclusion, the Markov chains discussed are very flexible and can be of great use for basketball organizations, school teams, and coaches alike.

References:

BasketballReference.com. 2018-19 NBA Season Summary. (n.d.). Retrieved November 30, 2019, from https://www.basketball-reference.com/leagues/NBA_2019.html#all_team_shooting

Bowers, B. (2019, June 8). Kawhi Leonard ties Kobe, LeBron with 14 30-point games in a single postseason. Retrieved November 17, 2019, from https://lebronwire.usatoday.com/2019/06/08/kawhi-leonard-ties-kobe-bryant-and-lebron-james-with-14-30-point-games-in-a- single-postseason/

Haynes, C. (2018, July 18). Kawhi Leonard has no desire to play in Toronto, league source tells ESPN. Retrieved November 17, 2019, from https://twitter.com/ChrisBHaynes/status/1019500916880240640

Knepper, P. (2017, September 22). Can a Team Without a Bona Fide Superstar Win an NBA Title? Retrieved February 1, 2020, from https://bleacherreport.com/articles/1615710-can-a-team-without-a-bona-fide-superstar-win-an-nba-title

NBA.com. (2019, March 19). 2019 NBA Playoffs. Retrieved October 12, 2019, from https://www.nba.com/playoffs#/

Zarum, D. (2010, June 8). James Naismith. Retrieved February 1, 2020, from https://www.thecanadianencyclopedia.ca/en/article/james-naismith

Zarum, D., & Grange, M. (2019, May 24). By The Numbers: Kawhi Leonard's 2019 playoff run among best all-time. Retrieved from https://www.sportsnet.ca/basketball/nba/numbers-kawhi-leonards-2019-playoff-run-among-best-time/

Zarum, D., Zwelling, A., & Grange, M. (2019, May 24). What they're saying after the biggest win in Raptors playoff history. Retrieved from https://www.sportsnet.ca/basketball/nba/theyre-saying-biggest-win-raptors-playoff-history/

Appendix

Table 5. Simulated Transition Matrix for when Kawhi Leonard is on the Court:

##	defensive stop	make 2	make 3	make ft	miss 2	miss 3
## defensive stop	0.00	0.00	0.00	0.00	0.00	0.00
## make 2	0.51	0.00	0.00	0.00	0.00	0.00
## make 3	0.58	0.00	0.00	0.00	0.00	0.00
## make ft	0.33	0.00	0.00	0.00	0.00	0.00
## miss 2	0.26	0.00	0.00	0.00	0.00	0.00
## miss 3	0.38	0.00	0.00	0.00	0.00	0.00
## miss ft	0.17	0.00	0.00	0.00	0.00	0.00
## no defensive stop	0.00	0.00	0.00	0.00	0.00	0.00
## offensive rebound	0.00	0.00	0.00	0.00	0.00	0.00
## shoot 2	0.00	0.42	0.00	0.00	0.58	0.00
## shoot 3	0.00	0.00	0.36	0.00	0.00	0.64
## shoot ft	0.00	0.00	0.00	0.83	0.00	0.00
## turnover	0.49	0.00	0.00	0.00	0.00	0.00

##	miss ft	no defensive stop	offensive rebound	shoot 2
## defensive stop	0.00	0.00	0.00	0.55
## make 2	0.00	0.39	0.00	0.00
## make 3	0.00	0.42	0.00	0.00
## make ft	0.00	0.24	0.00	0.00
## miss 2	0.00	0.25	0.19	0.00
## miss 3	0.00	0.40	0.18	0.00
## miss ft	0.00	0.20	0.13	0.00
## no defensive stop	0.00	0.00	0.00	0.55
## offensive rebound	0.00	0.00	0.00	0.59
## shoot 2	0.00	0.00	0.00	0.00
## shoot 3	0.00	0.00	0.00	0.00
## shoot ft	0.17	0.00	0.00	0.00
## turnover	0.00	0.51	0.00	0.00

##	shoot 3	shoot ft	turnover
## defensive stop	0.34	0.00	0.11
## make 2	0.00	0.10	0.00
## make 3	0.00	0.00	0.00
## make ft	0.00	0.43	0.00
## miss 2	0.00	0.29	0.00
## miss 3	0.00	0.03	0.00
## miss ft	0.00	0.50	0.00
## no defensive stop	0.32	0.00	0.13
## offensive rebound	0.31	0.00	0.10
## shoot 2	0.00	0.00	0.00
## shoot 3	0.00	0.00	0.00
## shoot ft	0.00	0.00	0.00
## turnover	0.00	0.00	0.00

Table 6. Simulated Transition Matrix for when Kawhi Leonard is not on the Court:

##	defensive stop	make 2	make 3	make ft	miss 2	miss 3
## defensive stop	0.00	0.00	0.00	0.00	0.00	0.00
## make 2	0.51	0.00	0.00	0.00	0.00	0.00
## make 3	0.45	0.00	0.00	0.00	0.00	0.00
## make ft	0.30	0.00	0.00	0.00	0.00	0.00
## miss 2	0.34	0.00	0.00	0.00	0.00	0.00
## miss 3	0.53	0.00	0.00	0.00	0.00	0.00
## miss ft	0.21	0.00	0.00	0.00	0.00	0.00
## no defensive stop	0.00	0.00	0.00	0.00	0.00	0.00
## offensive rebound	0.00	0.00	0.00	0.00	0.00	0.00
## shoot 2	0.00	0.42	0.00	0.00	0.58	0.00
## shoot 3	0.00	0.00	0.36	0.00	0.00	0.64
## shoot ft	0.00	0.00	0.00	0.85	0.00	0.00
## turnover	0.37	0.00	0.00	0.00	0.00	0.00

##	miss ft	no defensive stop	offensive rebound	shoot 2
## defensive stop	0.00	0.00	0.00	0.49
## make 2	0.00	0.44	0.00	0.00
## make 3	0.00	0.49	0.00	0.00
## make ft	0.00	0.27	0.00	0.00
## miss 2	0.00	0.37	0.12	0.00
## miss 3	0.00	0.31	0.16	0.00
## miss ft	0.00	0.08	0.00	0.00
## no defensive stop	0.00	0.00	0.00	0.57
## offensive rebound	0.00	0.00	0.00	0.42
## shoot 2	0.00	0.00	0.00	0.00
## shoot 3	0.00	0.00	0.00	0.00
## shoot ft	0.15	0.00	0.00	0.00
## turnover	0.00	0.63	0.00	0.00

##	shoot 3	shoot ft	turnover
## defensive stop	0.38	0.00	0.13
## make 2	0.00	0.05	0.00
## make 3	0.00	0.06	0.00
## make ft	0.00	0.43	0.00
## miss 2	0.00	0.18	0.00
## miss 3	0.00	0.00	0.00
## miss ft	0.00	0.71	0.00
## no defensive stop	0.36	0.00	0.07
## offensive rebound	0.55	0.00	0.03
## shoot 2	0.00	0.00	0.00
## shoot 3	0.00	0.00	0.00
## shoot ft	0.00	0.00	0.00
## turnover	0.00	0.00	0.00

Table 7. Mean First Passage Time Matrix when Kawhi Plays

##	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
## shoot 2	5.91	11.11	20.28	5.21	9.12	17.55	31.91
## shoot 3	5.19	10.40	24.82	10.40	14.31	6.43	20.80
## shoot ft	6.82	11.96	14.67	12.03	15.95	18.40	32.76
## miss 2	5.23	10.51	17.05	10.44	14.36	16.94	31.31
## make 2	4.49	9.60	22.19	9.70	13.61	16.04	30.41
## miss 3	4.20	9.47	23.62	9.41	13.32	15.90	30.27
## make 3	4.17	9.28	24.22	9.38	13.30	15.71	30.08
## miss ft	6.01	11.22	12.28	11.22	15.14	17.65	32.02
## make ft	5.78	10.91	13.96	10.99	14.91	17.34	31.71
## offensive rebound	2.90	8.70	22.98	8.11	12.03	15.14	29.50
## defensive stop	3.21	8.18	23.25	8.42	12.33	14.61	28.98
## no defensive stop	3.12	8.42	23.17	8.33	12.25	14.85	29.22
## turnover	4.16	9.31	24.21	9.37	13.28	15.74	30.11

##	miss ft	make ft	offensive rebound	defensive stop
## shoot 2	92.90	24.06	29.03	6.67
## shoot 3	97.44	28.60	27.81	5.97
## shoot ft	72.62	3.77	32.42	7.03
## miss 2	89.67	20.82	25.70	6.51
## make 2	94.81	25.96	31.07	4.56
## miss 3	96.23	27.39	24.69	5.50
## make 3	96.83	27.99	30.84	3.96
## miss ft	84.90	16.06	28.72	6.65
## make ft	86.57	17.73	31.98	5.90
## offensive rebound	95.59	26.75	29.85	7.30
## defensive stop	95.86	27.02	29.82	7.24
## no defensive stop	95.79	26.95	29.87	7.24
## turnover	96.82	27.98	30.85	4.91

##	no defensive stop	turnover
## shoot 2	7.37	31.48
## shoot 3	6.76	30.78
## shoot ft	8.16	32.32
## miss 2	6.90	30.89
## make 2	5.68	29.96
## miss 3	5.82	29.85
## make 3	5.64	29.64
## miss ft	7.71	31.60
## make ft	7.04	31.27
## offensive rebound	7.93	29.31
## defensive stop	7.86	28.74
## no defensive stop	7.85	28.50
## turnover	4.61	29.61

Table 8. Mean First Passage Time Matrix when Kawhi Does Not Play

	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
shoot 2	5.91	9.10	35.46	4.93	9.70	14.70	26.54
shoot 3	5.55	8.61	39.85	10.48	15.25	5.60	17.43
shoot ft	7.00	10.38	23.25	11.94	16.70	15.98	27.82
miss 2	5.16	8.21	32.32	10.09	14.85	13.81	25.65
make 2	4.56	7.95	37.49	9.49	14.26	13.55	25.39
miss 3	4.55	7.44	39.52	9.49	14.25	13.04	24.88
make 3	4.54	7.95	37.55	9.48	14.24	13.54	25.38
miss ft	6.62	9.99	15.77	11.55	16.31	15.59	27.43
make ft	5.86	9.24	23.75	10.80	15.56	14.84	26.68
offensive rebound	4.36	4.78	39.14	9.30	14.06	10.37	22.21
defensive stop	3.51	6.74	38.51	8.45	13.21	12.34	24.18
no defensive stop	3.23	6.81	38.25	8.16	12.92	12.40	24.24
turnover	4.34	7.78	39.35	9.27	14.04	13.38	25.22

	miss ft	make ft	offensive rebound	defensive stop
shoot 2	143.09	40.35	41.57	6.04
shoot 3	147.48	44.75	39.52	5.48
shoot ft	107.63	4.89	45.61	6.55
miss 2	139.94	37.21	38.73	5.53
make 2	145.12	42.38	43.17	4.35
miss 3	147.15	44.41	36.14	4.45
make 3	145.18	42.45	43.16	4.54
miss ft	123.40	20.66	45.22	6.08
make ft	131.38	28.65	44.46	5.43
offensive rebound	146.76	44.03	41.43	6.69
defensive stop	146.14	43.40	42.04	6.73
no defensive stop	145.88	43.14	41.93	6.79
turnover	146.98	44.24	42.97	5.15

	no defensive stop	turnover
shoot 2	6.21	35.83
shoot 3	6.23	35.40
shoot ft	7.52	36.67
miss 2	5.47	35.19
make 2	4.85	34.33
miss 3	5.54	34.41
make 3	4.64	34.39
miss ft	7.22	36.25
make ft	6.36	35.54
offensive rebound	7.14	35.43
defensive stop	6.89	31.96
no defensive stop	7.07	34.50
turnover	3.68	34.51

Table 9. Mean First Passage Time Matrix when Kawhi Plays, Minus Mean First Passage Time Matrix when Kawhi Does Not Play

##	shoot 2	shoot 3	shoot ft	miss 2	make 2	miss 3	make 3
## shoot 2	0.00	2.01	-15.18	0.28	-0.58	2.85	5.37
## shoot 3	-0.36	1.79	-15.03	-0.08	-0.94	0.83	3.37
## shoot ft	-0.18	1.58	-8.58	0.09	-0.75	2.42	4.94
## miss 2	0.07	2.30	-15.27	0.35	-0.49	3.13	5.66
## make 2	-0.07	1.65	-15.30	0.21	-0.65	2.49	5.02
## miss 3	-0.35	2.03	-15.90	-0.08	-0.93	2.86	5.39
## make 3	-0.37	1.33	-13.33	-0.10	-0.94	2.17	4.70
## miss ft	-0.61	1.23	-3.49	-0.33	-1.17	2.06	4.59
## make ft	-0.08	1.67	-9.79	0.19	-0.65	2.50	5.03
## offensive rebound	-1.46	3.92	-16.16	-1.19	-2.03	4.77	7.29
## defensive stop	-0.30	1.44	-15.26	-0.03	-0.88	2.27	4.80
## no defensive stop	-0.11	1.61	-15.08	0.17	-0.67	2.45	4.98
## turnover	-0.18	1.53	-15.14	0.10	-0.76	2.36	4.89

##	miss ft	make ft	offensive	rebound	defensive	stop
## shoot 2	-50.19	-16.29		-12.54		0.63
## shoot 3	-50.04	-16.15		-11.71		0.49
## shoot ft	-35.01	-1.12		-13.19		0.48
## miss 2	-50.27	-16.39		-13.03		0.98
## make 2	-50.31	-16.42		-12.10		0.21
## miss 3	-50.92	-17.02		-11.45		1.05
## make 3	-48.35	-14.46		-12.32		-0.58
## miss ft	-38.50	-4.60		-16.50		0.57
## make ft	-44.81	-10.92		-12.48		0.47
## offensive rebound	-51.17	-17.28		-11.58		0.61
## defensive stop	-50.28	-16.38		-12.22		0.51
## no defensive stop	-50.09	-16.19		-12.06		0.45
## turnover	-50.16	-16.26		-12.12		-0.24

##	no defensive stop	turnover
## shoot 2	1.16	-4.35
## shoot 3	0.53	-4.62
## shoot ft	0.64	-4.35
## miss 2	1.43	-4.30
## make 2	0.83	-4.37
## miss 3	0.28	-4.56
## make 3	1.00	-4.75
## miss ft	0.49	-4.65
## make ft	0.68	-4.27
## offensive rebound	0.79	-6.12
## defensive stop	0.97	-3.22
## no defensive stop	0.78	-6.00
## turnover	0.93	-4.90