

The “Pass” To Victory

A Visualization of Passing Scenarios to Maximize Assists

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Introduction & Rationale:

Passing has always been an underappreciated skill that is pivotal to the game of basketball. Whether it be classic stars like [PLAYER] and [PLAYER], or promising young guys like [PLAYER] and [PLAYER], a player's ability to facilitate an offense can be just as important, if not more important, as the offense itself.

While many “heat maps” for shots exist, my report aims to illustrate similar visualizations for passes. Furthermore, my report will discuss the how distance and time factor into the number of assists a team gets. Throughout my report, the number of recorded assists will be viewed synonymously to success.

Especially for [TEAM], it becomes more important to avoid seeking big name stars in free agency or trades. Especially with [DEALS MADE], passing among a few players is arguably a more valuable skill than the pure stardom of a single player.

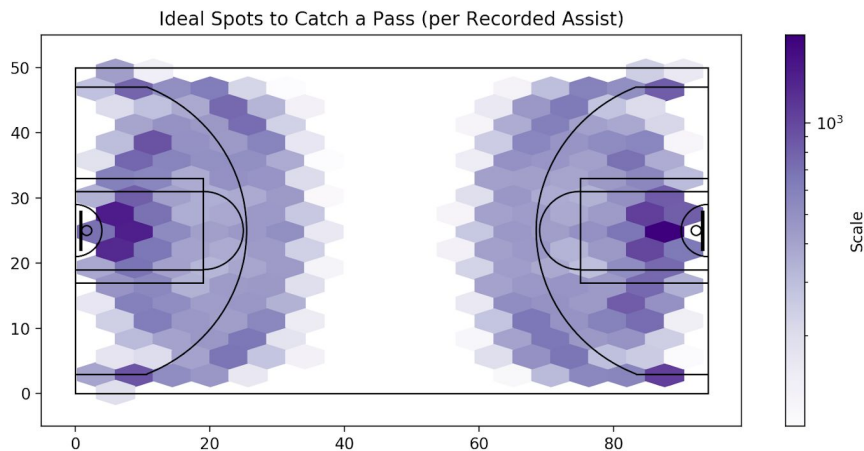
Furthermore, just as there are “high percentage shots” that people can take, this report tries to discover certain “high percentage passes” that can help guide coaching staff and players to a more strategic offensive game plan. I use recorded assists as a measure of good passes because assists signify passes that directly led to points.

Method:

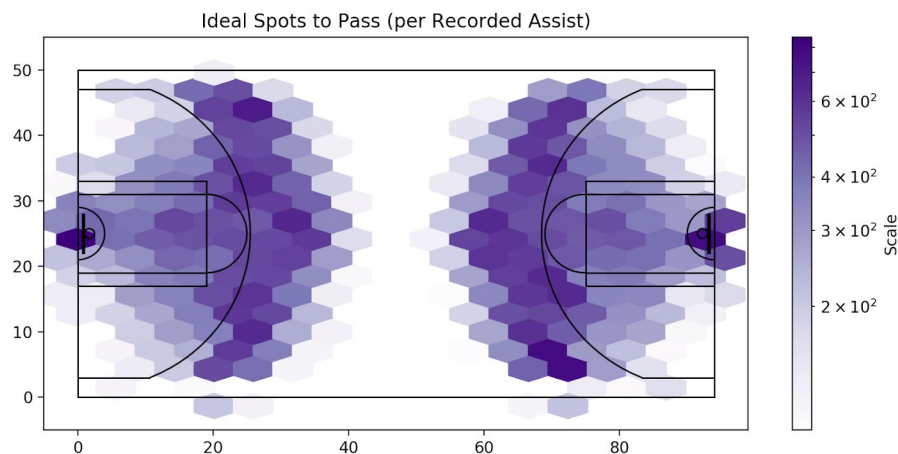
1. **Ask Question:** How do different situations affect the ability of a passer to get an assist?
 - a. Does the position of the passer on the court matter?
 - b. Does the position of the player who catches the pass matter?
 - c. How does the distance traveled by the pass change likelihood of an assist?
 - d. Does passing behavior change with when in the game it is?
2. **Cleanup Data:** Utilize Microsoft Excel capabilities to sort data as necessary
 - a. Sorting by Recorded Assists for Hexbins
 - b. Summation of recorded assists to use total for condensed comparison
 - c. Sorting by Team ID to get [TEAM] specific data
 - d. Sorting by Quarter & Season to visualize data over time
3. **Modeling:** Use *matplotlib*, Excel, and *bokeh* to create visualizations
 - a. Hexbin (2D Histogram) of ideal catching / passing locations for league / [TEAM]
 - b. Interactive version of hexbins using *bokeh* (HTML on github)
 - c. Scatterplot illustrating relationship between pass distance and recorded assists
 - d. Table of standout players
 - e. Triple-bar bar graph to see how assists vary across quarters and seasons

League Wide Passing:

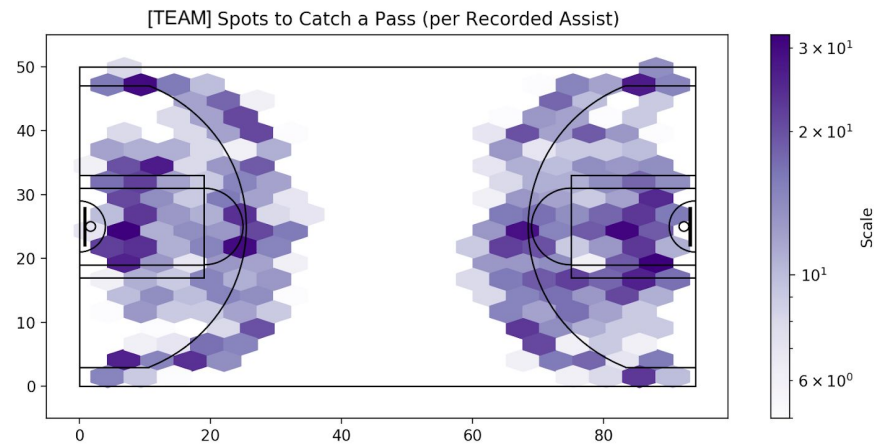
This graph (as well as the later ones) shows locations where a pass is caught and then converted into recorded assists. Each hexagon represents a physical region. The color represents the number of recorded assists in that region, indicated by the color bar to the right.



From the provided data, (2014-2016 NBA Season), this graph illustrates certain hotspots for passes that led to recorded assists including near the paint and the corner outside the three point line. It makes sense that many “good passes” are caught in the paint for an easy layup or in the corner for an open three. This begs the question, where do these passes come from?

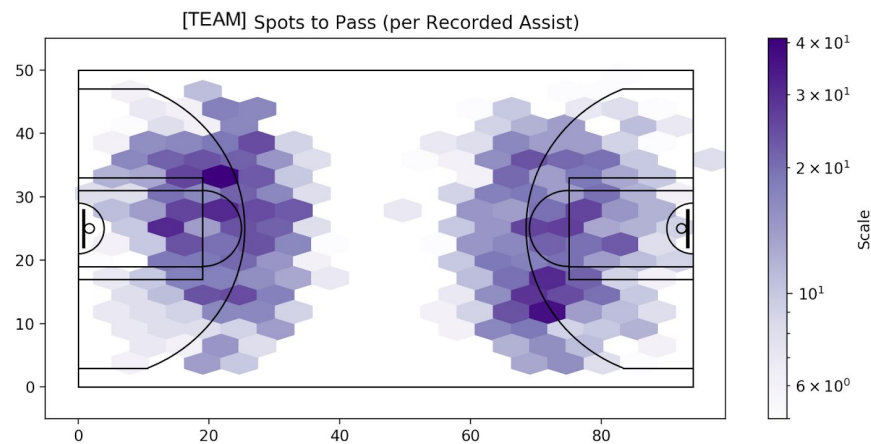


This graph gives a representation of some ideal places to pass the ball. League wide, many passes come from outside the perimeter. There seems to be a tight concentration of good passes very close to the basket as well. This can be credited to inbound plays or short inside passes as mentioned earlier. These two graphs show trends in the entire league’s passing over three seasons. The next two will show trends in the [TEAM] passing over the same span of three seasons.

[TEAM] Passing:

The [TEAM] have more inside passing than the league does at large. There is also a slightly heavier focus on catching corner three's and top of the key three's as opposed to roughly uniform distribution of passes caught league wide. The catches and the top of the key can also be explained by high pick and roll plays.

Around 72 assists are caught at the low block, 58 at the top of the key, and 94 split between either corner. It appears as though a decent chunk of the [TEAM]'s scoring starts from deep inside the paint, the corners, and the top of the key.

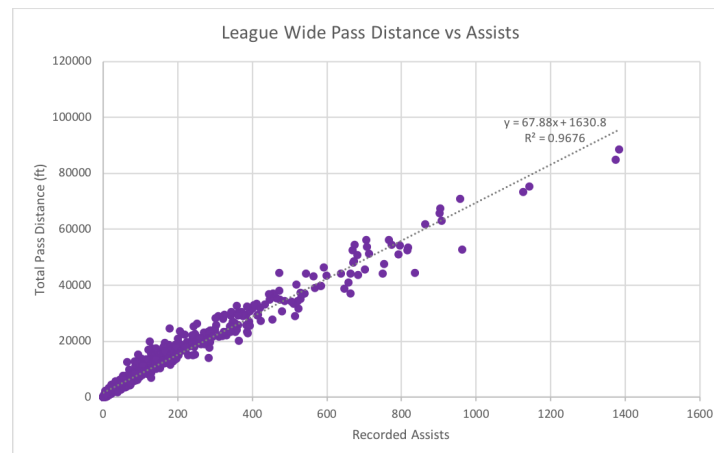


The spots signifying where these passes are initiated seem to indicate a right-side heavy offense. More assists come from the right wing and left elbows and less from inside. The color is most intense around the right wing. About 40 assists come from this most concentrated region, not including the assists that come from the last concentrated regions surrounding it.

This diagram can be used in giving coaching staff a better idea of what the offenses they plan are actually translating to in game. For example, this right-wing heavy offense could be unintentional and something to practice.

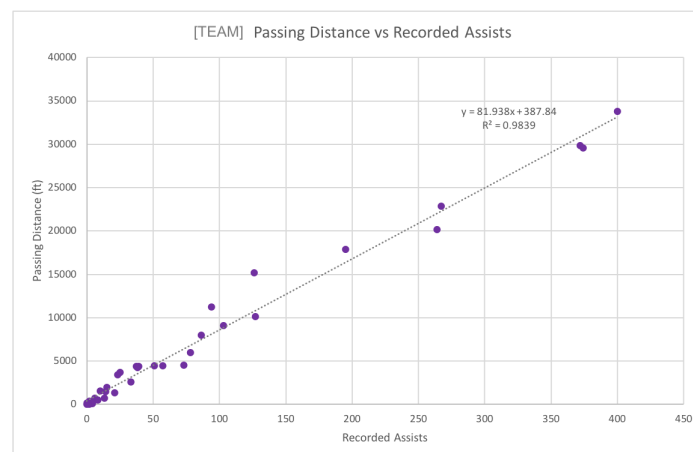
League Wide Passing Distance:

The following two graphs are scatterplots of compiled data. Using python scripts, I found the sum of each unique player's assists and pass distance and appended it onto their player data. Analyzing pass distance can give valuable insights into what length passes lead to assists and what kind of court spacing should be maintained. It is rather intuitive that with more assists lead to more passes and further distances traveled. As such, these scatterplots do not have too much predictive power, but are still useful visuals.



This scatter plot displays the assists and pass distance for all players in the league in the 2014-2016 seasons. I can see there is a strong, positive, and linear association with the number assists a player has and the total distance his passes have traveled. There do not appear to be any outliers, such as someone who has many assists off of short passes, or few assists off of long passes.

[TEAM] Passing Distance:



Unlike earlier with passing locations, the relationship between assists and pass distance for the [TEAM] closely mirrors that of the entire league's. One could argue that there are slightly more players "above the line" (have more assists and longer distance).

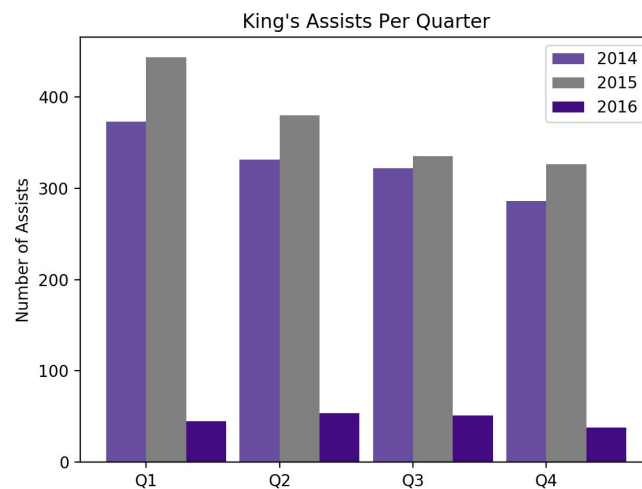
Standout Players:

Name	Position	Recorded Assists	Passing Distance (ft)	Passing Distance (miles)
[PLAYER 1]	PG	400	33,772' 5"	6.396
[PLAYER 2]	PF/C	374	29,556'	5.598
[PLAYER 3]	SF/PF	372	29,830' 10"	5.650
[PLAYER 4]	PG	267	22,896' 6"	4.336
[PLAYER 5]	PG	264	20,153' 8"	3.817
[PLAYER 6]	SG	195	17,867' 9"	3.384

This table displays a more detailed view of the information from the scatterplot above. In 2014, 2015, and 2016, the [TEAM]' top six performers (in terms of assists) include some great guards like [PLAYER 1], wing players like [PLAYER 3], and even big men like [PLAYER 2]. One deviation of passing distance playing a role is the difference between these two players. While [PLAYER 2] has more assists than [PLAYER 3] (2 more), [PLAYER 2] has noticeably less passing distance (6726ft less). Even so, as assists increase, so does passing distance.

Quarter By Quarter:

In a similar compiling manner as the scatterplots, this bar-graph is the sum of total assists grouped by quarter and season. There are four groups of three bars, with each bar representing the total number of assists in a season, and each group representing the quarter.



It appears that the [TEAM] pass more often in the first quarter than they do any other quarter (except for 2016). This hints at an offensive where the ball is shared less and less as the game goes on. Note the large gap between assists in 2015 and 2016 may be because of a computation error or data collection error. Regardless, the general trends are still there.

Conclusion:

This report views three aspects of passing in the [TEAM]'s offense: location, distance, and timing. The hexbin diagrams suggest a right-wing heavy offense for the [TEAM]. The scatterplots show a strong positive relationship between assists and passing distance, with strong examples including [PLAYER] and [PLAYER]. Finally, the [TEAM]'s focus on passing seems to decrease as the game goes on.

Passing is an integral part of the game of basketball and can be difficult to get good at, especially due to its dependence on others. However, good ball movement and effective passes can allow teammates to score in more efficient and accurate ways. Especially as the three point shot becomes increasingly important in team strategy, demand for young guards like [PLAYER] who can facilitate these threes and other offensive opportunities becomes important as well. I hope that this report can provide some valuable information to the [TEAM] and give the organization another thing to consider when making game strategies as well as offseason moves.

Future Musings:

In the future, I would like to continue analyzing how passing influences the game of basketball. For example, there could be a difference between passes that lead to points and the actual number of recorded assists. A stacked histogram would be very beneficial in visualizing this. I also would like to develop a more detailed interactive visualization, where hovering over a hexagonal region of passing location would highlight that region's ideal catching locations (maybe the right elbow's catch location is the right block in a pick and roll scenario). In addition, it could be helpful to highlight the names of a few players who are particularly dominant in certain locations (like how [PLAYER] may be particularly adept at facilitating offense within the paint).

Github Dictionary of Diagrams:

1. Ideal Spots To Catch A Pass (per Recorded Assist)
 - a. Data: complete_data.csv
 - b. Code: test.py
2. Ideal Spots To Pass (per Recorded Assist)
 - a. Data: complete_data.csv
 - b. Code: test.py
3. [TEAM] Spots To Catch A Pass (per Recorded Assist)
 - a. Data: [TEAM]_Data.csv
 - b. Code: test.py
4. [TEAM] Spots To Pass (per Recorded Assist)
 - a. Data: [TEAM]_Data.csv
 - b. Code: test.py
5. League Wide Passing Distance vs Assists
 - a. Data: Assist_Sum.csv
 - b. Code: assist_sum.py
6. [TEAM] Passing Distance vs Assists
 - a. Data: Assist_Sum_[TEAM].csv
 - b. Code: assist_sum.py
7. Table of Standout Players
 - a. Data: Assist_Sum_[TEAM].csv
8. [TEAM]'s Assists per Quarter
 - a. Data: [TEAM]_Data.csv
 - b. Code: quarterpass.py
9. NOT SHOWN IN REPORT. To see, load locally
 - a. Interactive Hexbin Visualizations
 - b. Data: Refer to Diagrams 1-4
 - c. Code: bokeh_test.py
 - d. Website: Complete_Pass.html (League Wide)
 - e. Website: [TEAM].html