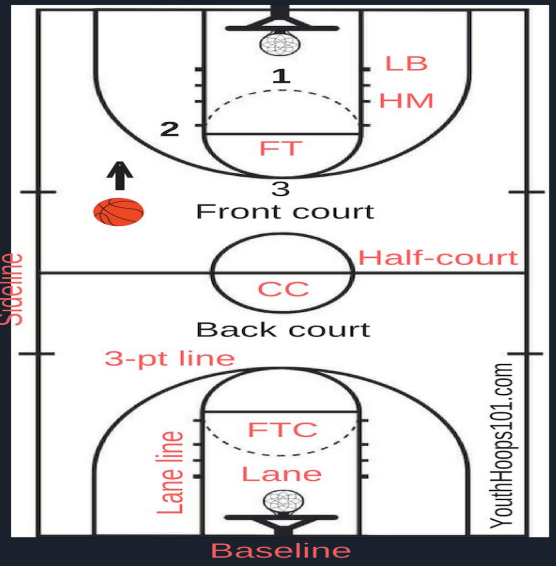
3 Point Revolution

By: Nick de Jonge, Shreeman Gautam

Table of Content

Overview

- 3 pointers are scored from beyond the 3-point line(see image), in the sport of basketball.
- A recent general consensus is that successful 3 pointers have increased significantly over the last 12 years.
- Historically, 3 pointers were scarcely used. Players opted for 2 pointers, see image where it says 2 & 1, 2 being mid-range shots and 1 being paint shots(dunks, layups etc.).
- 2 pointers were used more frequently and 3 pointers were saved for dire circumstances(like when teams couldn't penetrate the other team to score 2 pointers at the very end of the game).
- Consequently, many players were discouraged from taking 3 pointers.
- Starting in the 2010s, the ratio of 3 pointers to mid-range shots attempted went up significantly, 0.72 in 2010 and 3.05 in 2021.
- Statistical models indicated that attempting 3 pointers made teams more offensively efficient, revolutionizing basketball.
- Basketball, historically a tall man's sport, peaked in 2010 for average height for players and has been declining since.
- Consequently, the game has become more skill based.

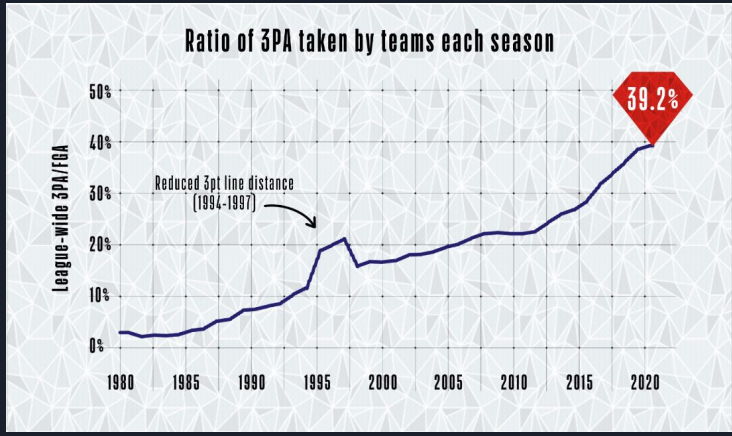


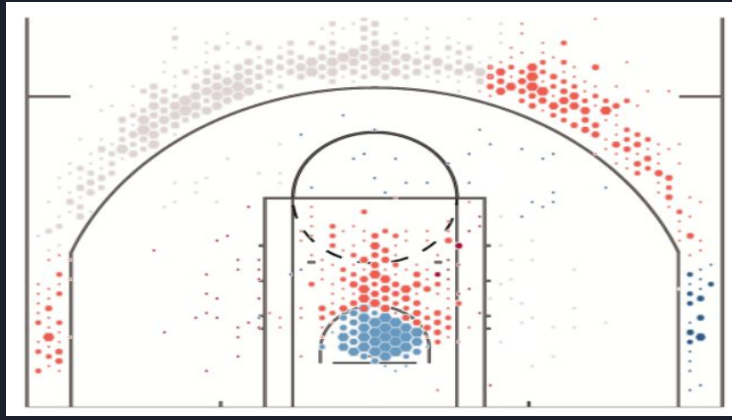
Motivation

- Our aim is to highlight the increase in the number of successful and attempted 3 pointers over the last 12 years using linecharts, heatmaps and storytelling.
- Accordingly, our hypothesis is that 3 pointers have increased significantly over the last 12 years.
- Nick(left image) loves basketball and is highly familiar with the intricacies of basketball.
    - He holds a personal interest in the sport and the trend of modern play styles.
    - He has a good eye for visualization and making the custom heatmap was his idea.
    - Given the amount of data for basketball, he thought it was a good idea to pursue this project.
- Shreeman(right image) doesn't know much about basketball but knows enough to do research on this project.
    - He follows soccer and uses statistical models from https://fivethirtyeight.com/(fiveThirtyEight) and analysis from https://www.youtube.com/c/FPLFocal/videos(FPLFocal) to set up his soccer team weekly in https://fantasy.premierleague.com/(Fantasy Premier League).
    - He loves working with data and his PhD will be focused mostly on data analytics and visualization of networks.
    - Given his love for sports in general, Shreeman thought it was a good idea to pursue this project.

Related Work

- This website offered us the initial idea of 3 pointers rising over the last 10 years: https://www.nba.com/news/3-point-era-nba-75(image on the top right is from this website).
- This website's direction allowed us to pull data feasibly using python: https://datavizardry.com/2020/01/28/nba-shot-charts-part-1/. The author of the website also makes heatmaps but he does it using Tableau: https://datavizardry.com/2020/02/03/nba-shot-charts-part-2/ (image on the bottom right is from this website).
- Our visualization is done using javascript(d3), html and css.





Questions

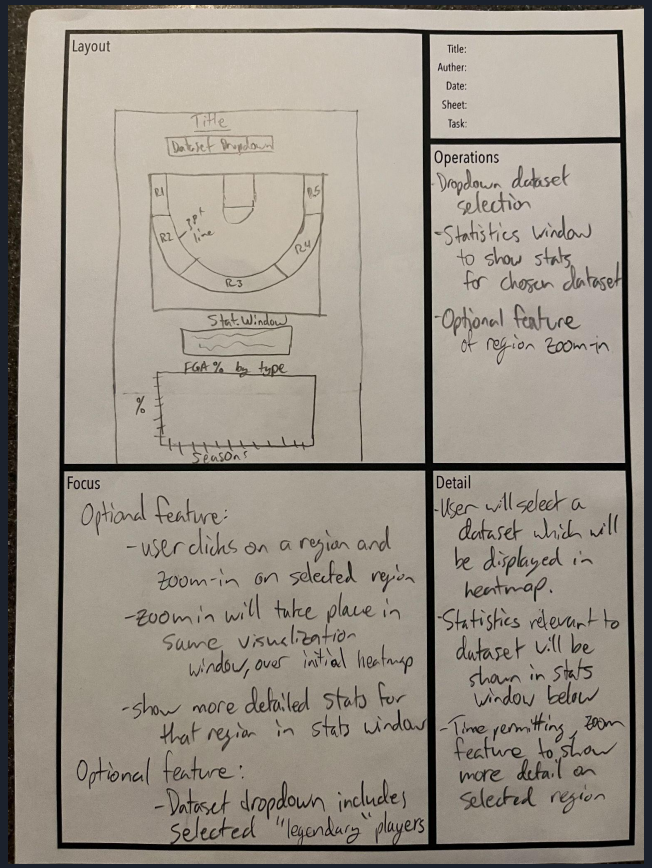
- Initially, we thought that having a heatmap for 12 seasons, where each season would be shown using a dropdown, was effective to validate our hypothesis. However, one would not be able to differentiate any 2 seasons because only one season's heatmap is shown at the click of the dropdown. If 2 heatmaps cannot be compared side by side, we are not visually communicating our hypothesis.
- So, in order to validate our hypothesis, we made 2 static linecharts. 1 linechart shows the % of 3 pointers rising over the last 12 years. Another linechart shows the top 52 players, of all time, by points gained from successful 3 pointers. From these 52 players, 45 played past 2010, which is our starting point.
- Finally, these 2 linecharts are supplemented by the heatmap. Now, when viewers use the heatmap, they can rest easy knowing that the number of rectangles used to make the heatmap, is generally increasing(obviously, there are exceptions) from 2010 to 2022.
- All the visualizations mentioned here will be explained more starting from the heatmap section.

Data

- Using this website: https://datavizardry.com/2020/01/28/nba-shot-charts-part-1/, we learned about a library in python called nba_api.
- nba_api has a module called stats.endpoints.shotchartdetail
- In this module, there is a parameter called 'context_measure_simple', which allows us to find information(for the whole league starting from 2010) such as number of successful 3 pointers, attempted 3 pointers, successful 2 pointers, attempted 2 pointers and so on.
- All this data is used to construct 4 of the 5 charts.
- The information for the 5th chart, which is the top 52 players linechart, was found in this website: https://www.nba.com/stats/alltime-leaders?SeasonType=Regular%20Season&StatCategory=FG3M. We simply hardcoded values(games played, 3 points made) given in this website.

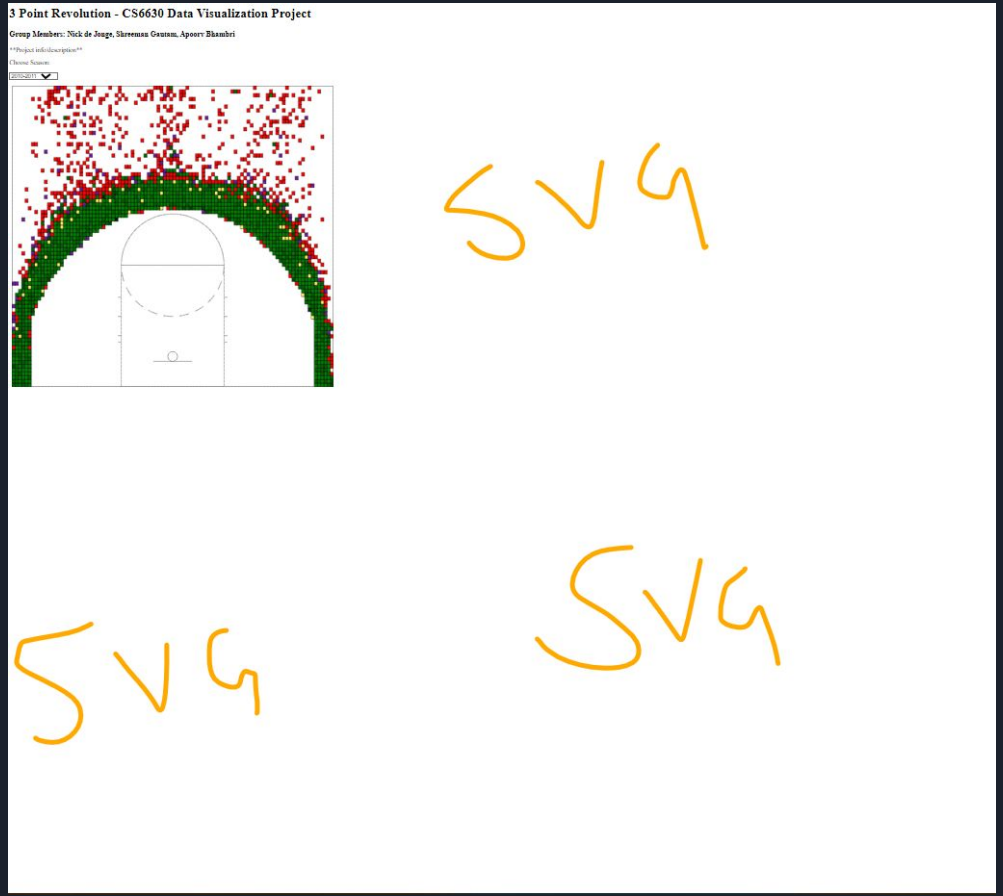
Evolution of Design

- The picture on the right shows our initial sketch for the data. Our final visualization contains the court(with the heatmap, shown on the right) and the FGA% by type chart(shown on the right), and 3 other charts(not part of our initial sketch).
- The stat window(shown on the right) led us to make the 3 other linecharts, one interactive chart for team, one interactive chart for player and one static chart for top 50 players.
- We kept the dropdown idea(shown on the right).
- We discarded the zoom in idea and the 5 regions idea. Instead, we made small color-coded rectangles where each rectangles serves as a region. The small rectangles also freed us from doing a zoom in feature since the rectangles were laid out in a granular manner anyway.
- We did not make sketches after the project milestone. From the start, we were committed to representing the data as a heatmap and a linechart and our final visualization shows that(1 heatmap, 4 line charts). Therefore, we did not look at many avenues of visualization.



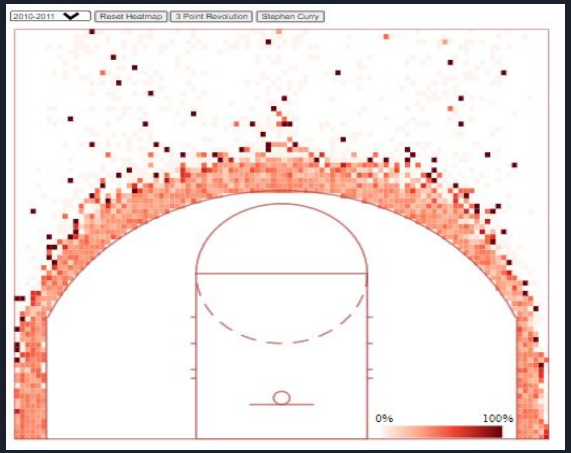
Evolution of Design(contd.)

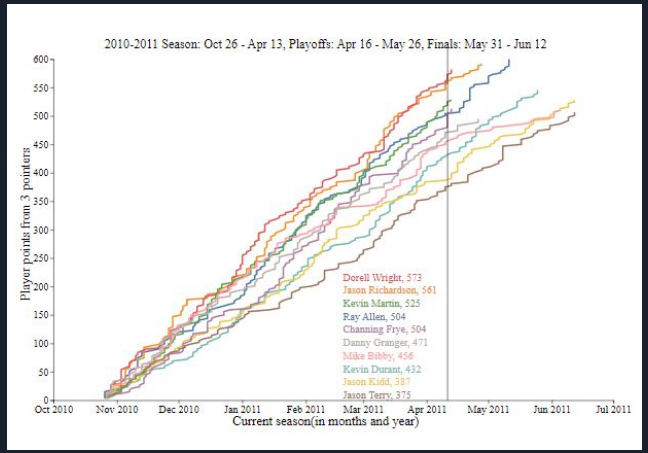
- After we got our heatmap working, we thought of adding 3 more linecharts. Eventually, we added 4 and this picture shows what we intended to do.

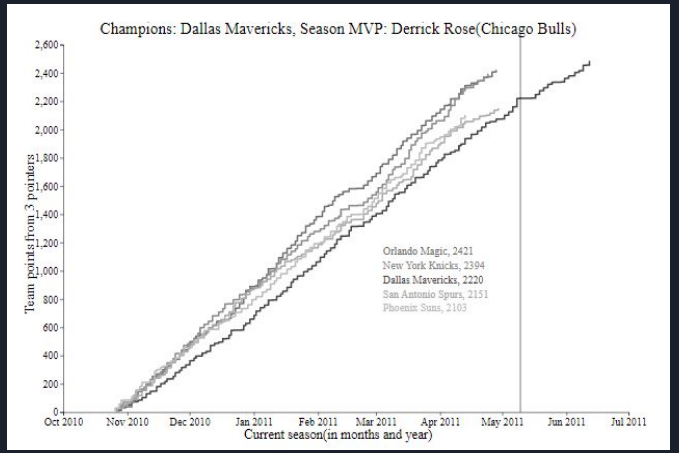


Dropdown

- Our data comprises of 12 seasons of the NBA, starting in 2010-11 and ending in 2021-22.
- For each season, we use our dropdown to show the league heatmap, the 10 best players(by 3 pointers scored) and the 5 best teams(by 3 pointers scored). This is the information for the 2010-11 season.
- The next 5 sections will explain the 5 visualizations we have in our project.

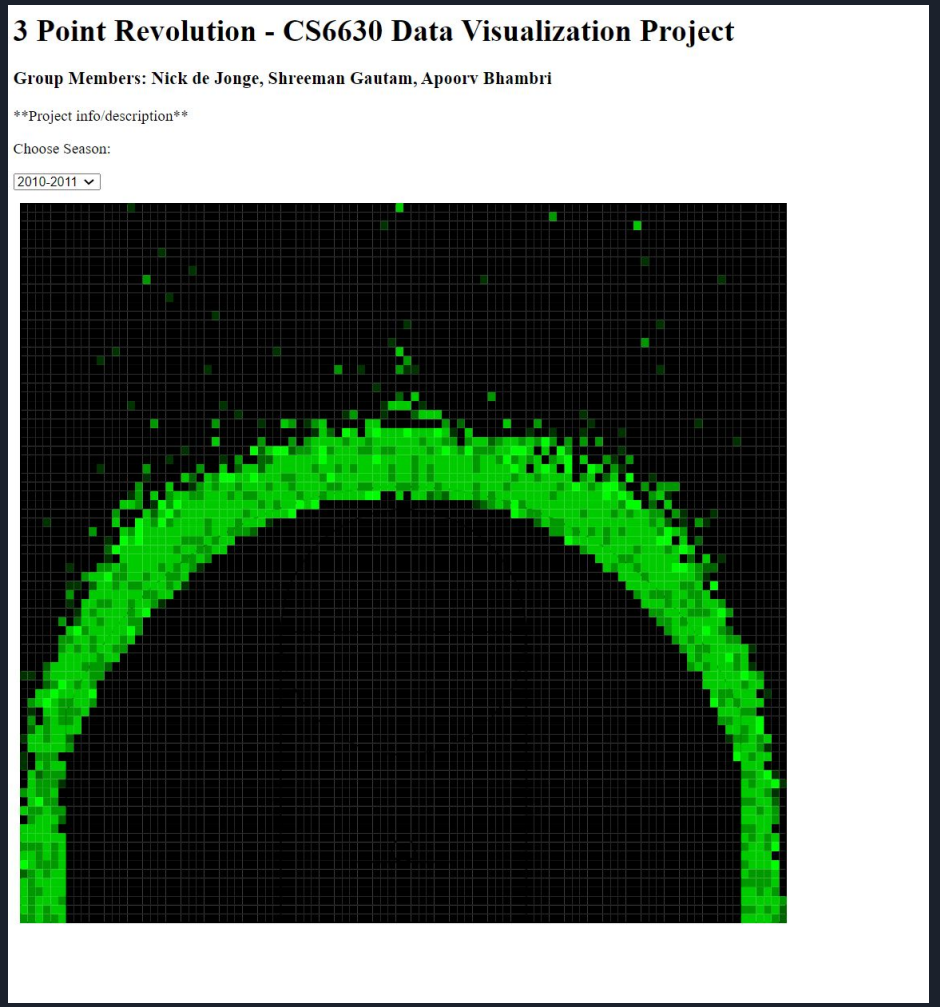






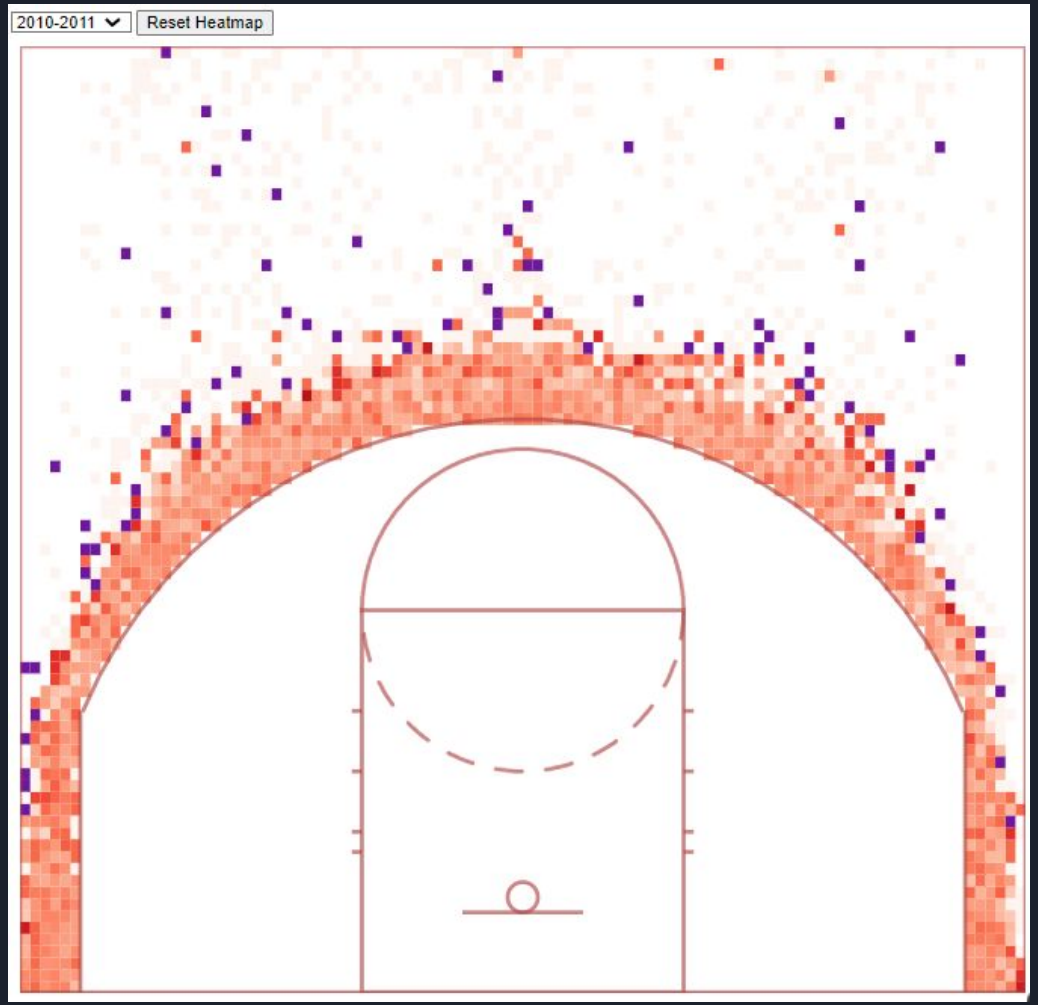
Heatmap

- After we got our data in, we color coded the rectangles but as you can see, the court is not visible and the colors do not communicate anything.



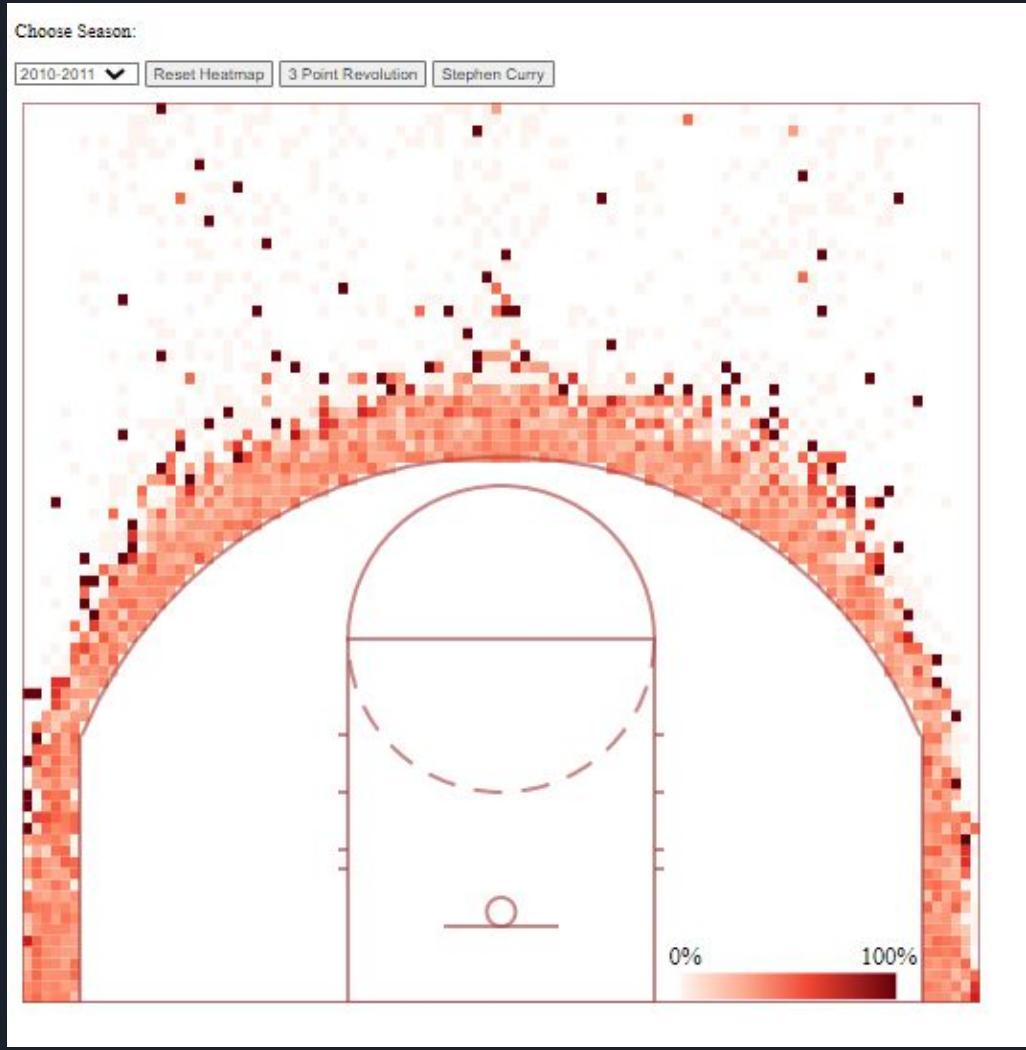
Heatmap(contd.)

- At this point, we decided that red was the best color. There was one glaring problem though. What does the purple mean?
- We thought that purple would fit here because it conveys royalty but this does not mesh well with the sea of red.
- We made the court visible and kept errant rectangles out of the 3 point line.



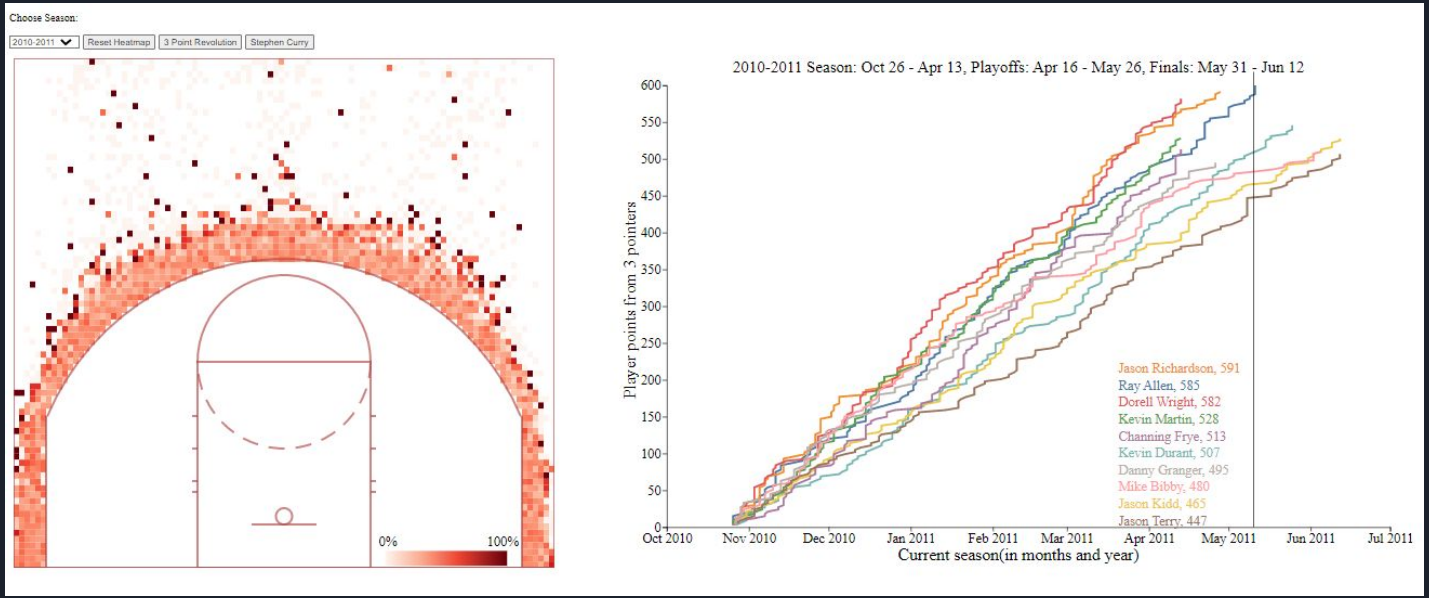
Heatmap(contd.)

- This is our final heatmap. We stuck with red because we wanted to have one color for the whole heatmap. The darkest red was formerly purple.
- The reset heatmap button exists to return the heatmap to the current season's state after we use interaction on the other 2 linecharts(more on this later).
- Essentially, the darkest shade of red means that every shot taken from that position on the court was successful. The lightest shade of red communicates the opposite. The legend conveys this information
- If a position did not have shots(therefore any position within the 3 point line and many positions outside of it), they are color-coded white.



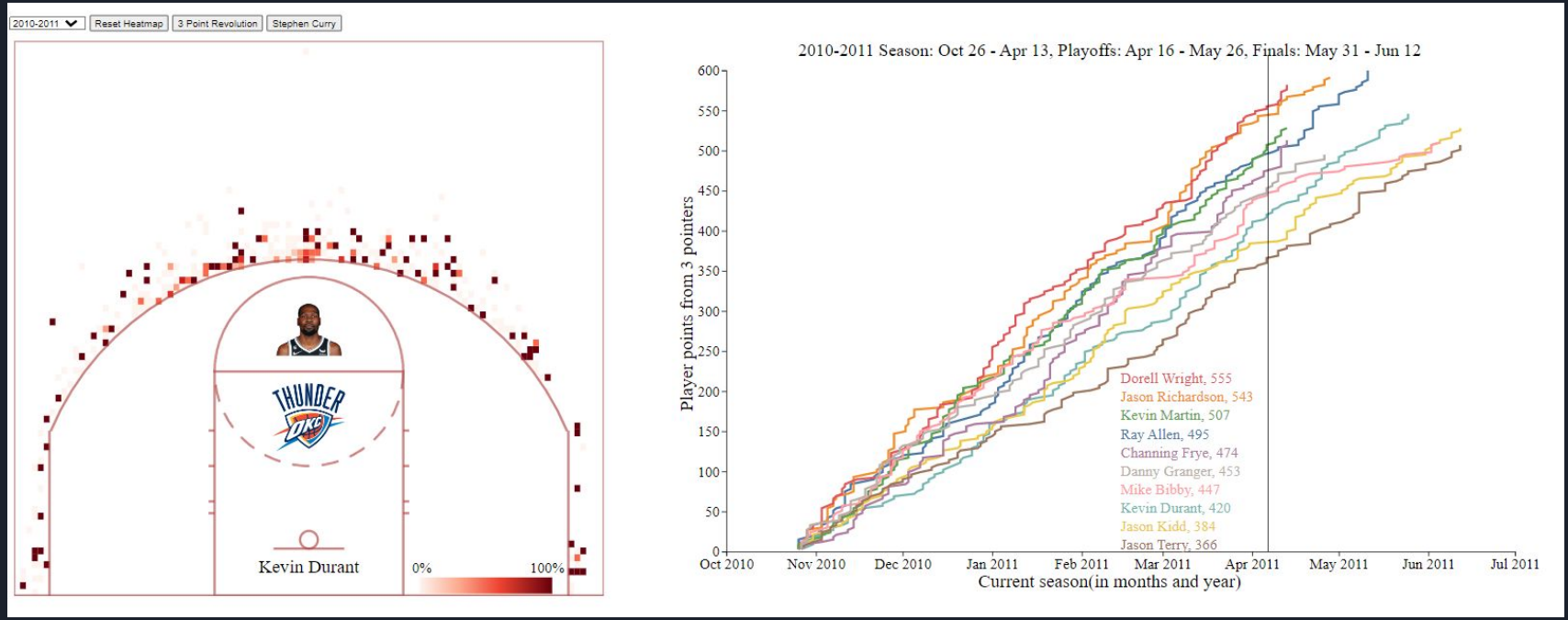
Interaction: Player Heatmap

- Initially, we did not have interaction for the player line chart. The cursor is not showing but currently it's on the player Jason Terry, brown line on the linechart. After consulting with the Professor, we realized that we could show the heatmap for any player of that season.
- This linechart, on its own, serves a function by telling us who the best player(s) is/are that season judging by 3 pointers scored and which player(s) made it to the finals. For 2010-11, the blue line rises the highest: Jason Richardson was the best player. The yellow and the brown lines stop mid June. If the season ended on June 12, Jason Kidd and Jason Terry made it to the finals.



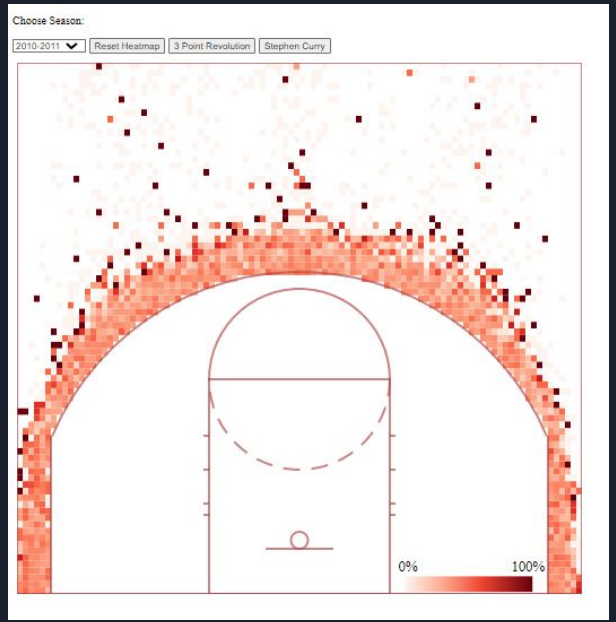
Interaction: Player Heatmap(contd.)

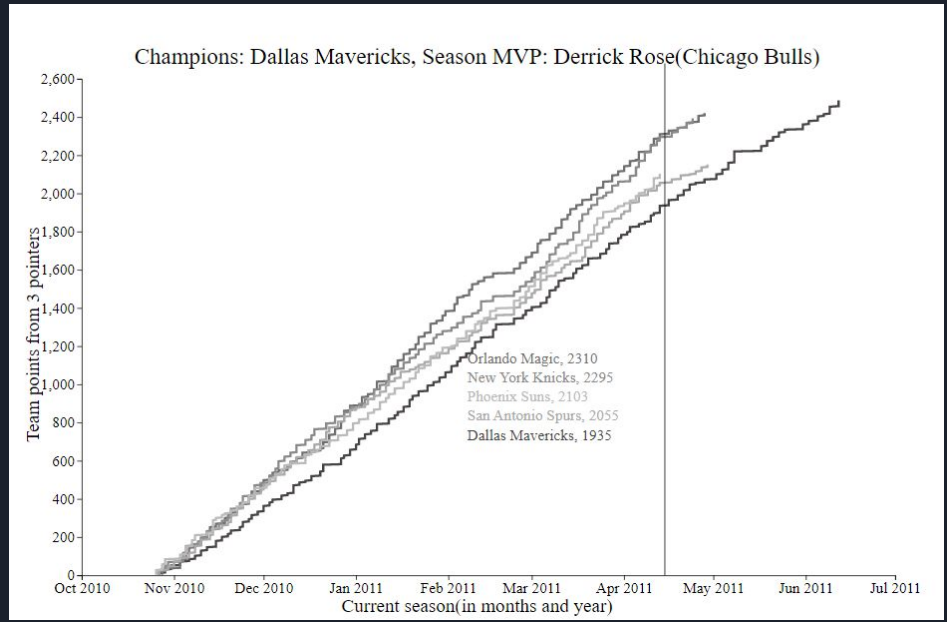
- We added interaction, which shows a player's heatmap for that season when that player is hovered over on the line chart. Currently, the cursor(not seen here) is on Kevin Durant and the heatmap will reflect that. The heatmap will also show the player's face, his team that season(Durant played for Oklahoma City Thunder in 2010-11) and his name.



Interaction: Team Heatmap

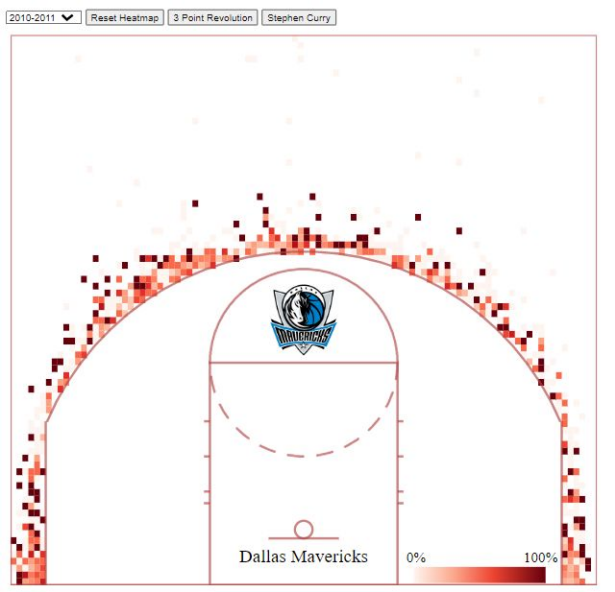
- Initially, we did not have interaction for the team line chart. The cursor is not showing but currently it's on the team Dallas Mavericks, the most black line on the linechart. After consulting with the Professor, we realized that we could show the heatmap for any team of that season.
- This linechart, on its own, serves another function by telling us who the best team(s) is/are that season judging by 3 pointers scored and which team(s) made it to the finals. For 2010-11, the most black line rises the highest: Dallas Mavericks was the best team. The most black lines stop mid June. If the season ended on June 12(the player line chart gives us this information), the Mavericks also made it to the finals.
- Finally, in order to avoid confusion between the team line chart and the player line chart, we made the team line chart grey as opposed to the vibrant colors of the player line chart. We did not want to communicate the idea that the player and team line chart were connected in any way.

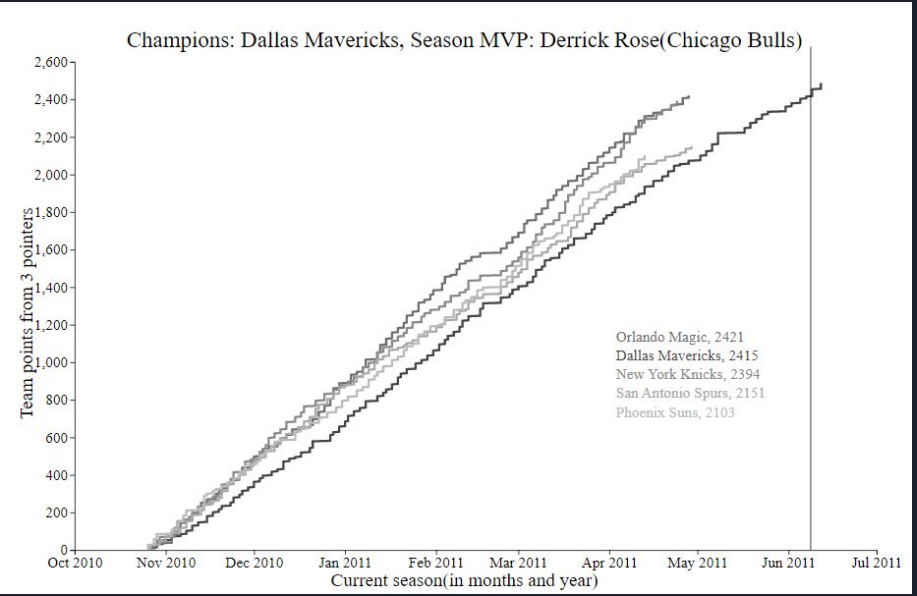




Interaction: Team Heatmap(contd.)

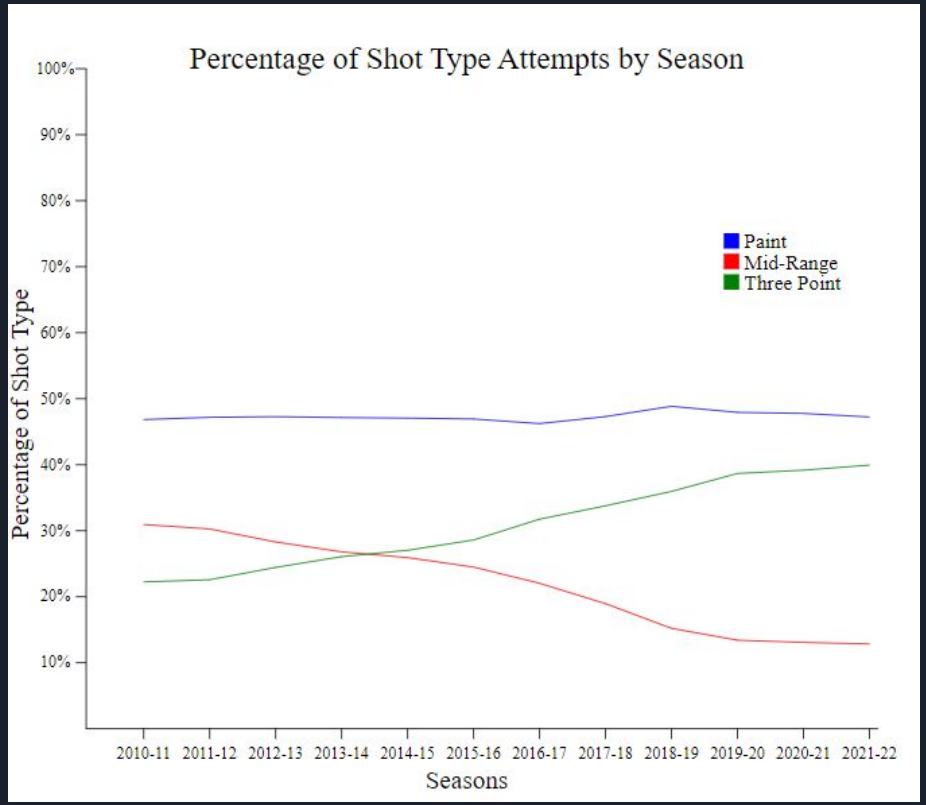
- We added interaction, which shows a team's heatmap for that season when that team is hovered over on the line chart. Currently, the cursor is on Dallas Mavericks and the heatmap will reflect that. The heatmap will also show the team's logo and the team's name.





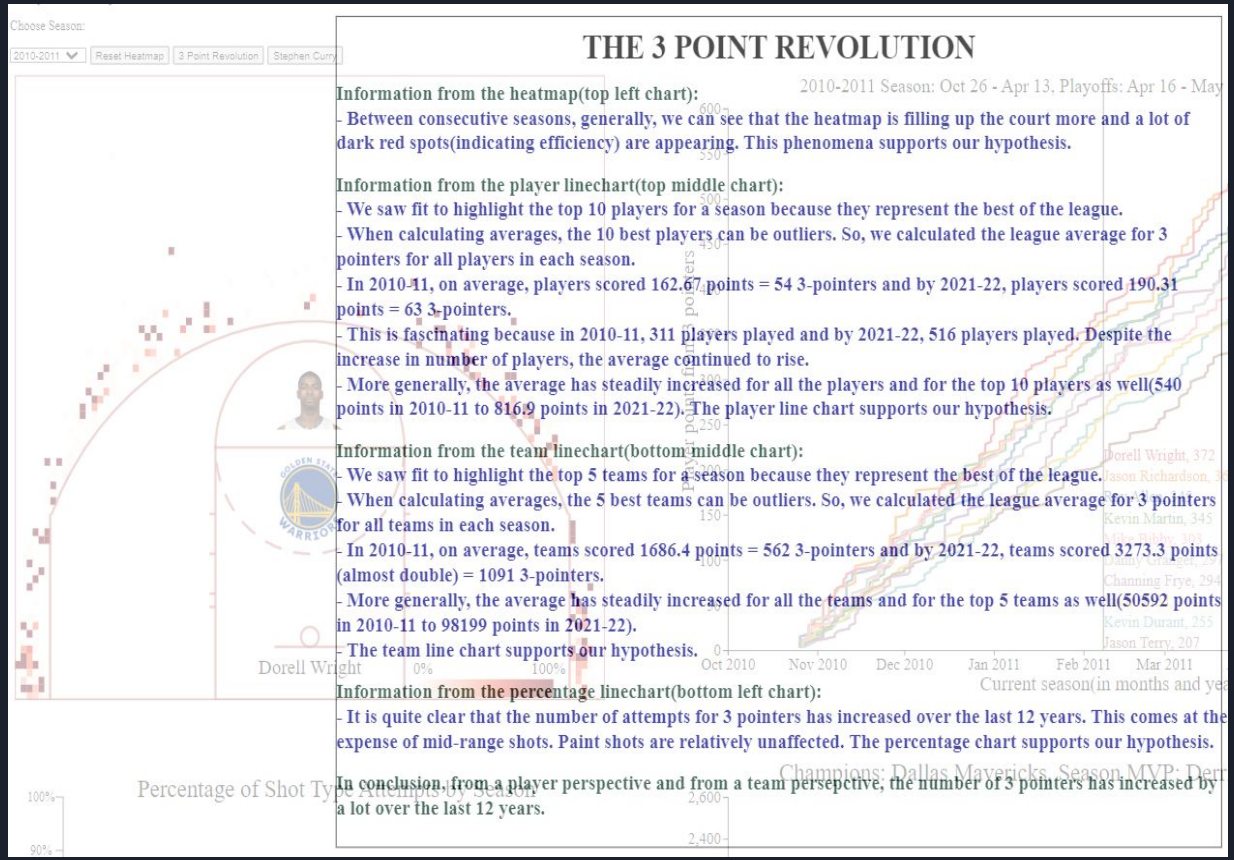
Storytelling: Increase of 3 pointers

- While the interactive linecharts make for a good visualization, they don't tell a story.
- Due to the dropdown, the viewer cannot compare(using heatmap or the interactive linecharts) two seasons side by side.
- Therefore, we stuck to our original idea and produced this static chart.
- This chart, in conjunction with the heatmap and the interactive linecharts, give credence to our hypothesis, which is, that 3 pointers have truly increased over the last 12 years.



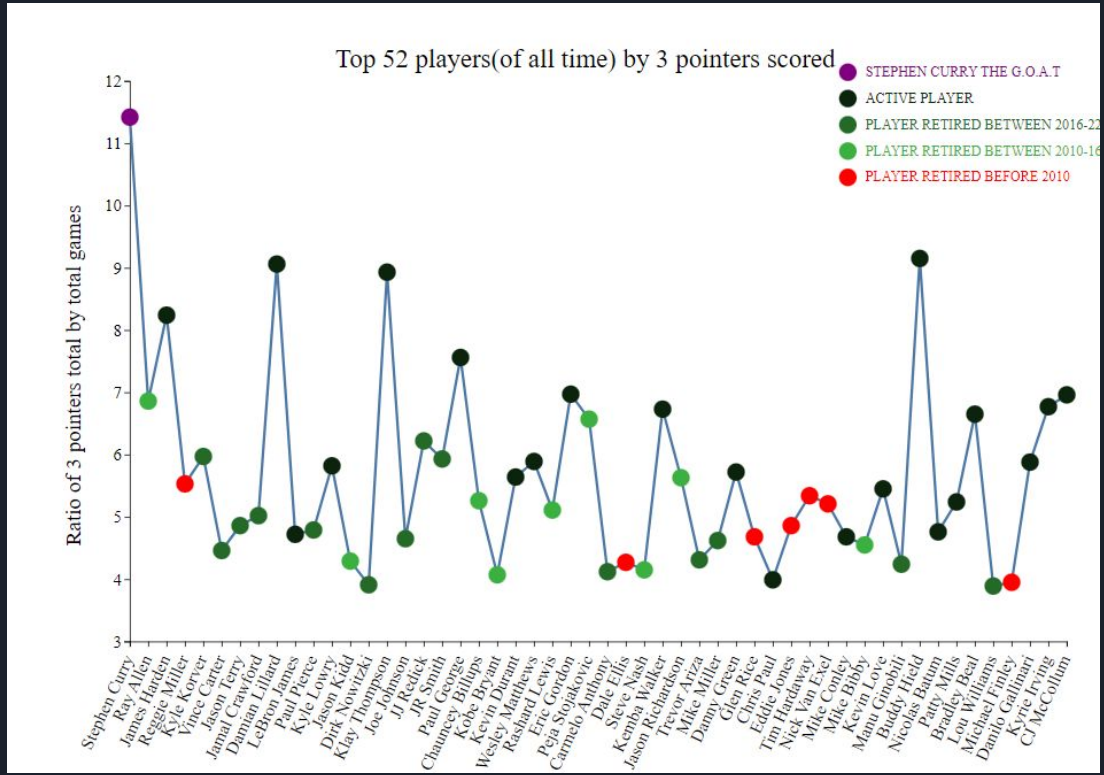
Storytelling: Increase of 3 pointers(contd.)

- If the 3 Point Revolution button is clicked , this overlay ,with information, will pop up.
- While this overlay is active, none of the other charts will work.
- Simply clicking anywhere on the window will allow the user to exit this overlay.
- The text on this overlay does the storytelling.



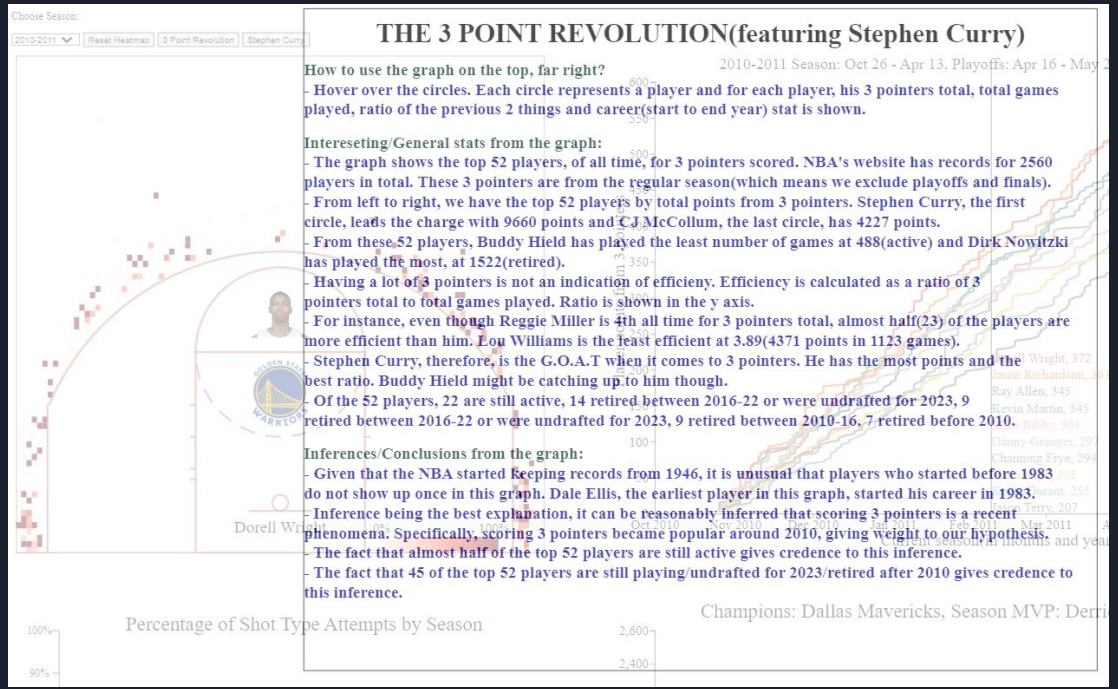
Storytelling: Top 52 players

- The graph shows the top 52 players, by 3 pointers scored, from left to right. The ratio is a metric of efficiency. For instance, Ray Allen is the 2nd highest 3 point scorer of all time.
- The colors for this graph serve to prove a point.
- Our hypothesis is that 3 pointers have increased after 2010.
- Therefore, any player who retired before 2010 is against our hypothesis, hence the color red.
- Any player who is still playing or retired after 2010 or undrafted for 2023 supports our hypothesis, hence the green shades.
- Stephen Curry is a special case, in that, he has the most 3 pointers and has the best ratio. He is awarded the color of royalty, purple.



Storytelling: Top 52 players(contd.)

- If the Stephen Curry button is clicked , this overlay ,with information, will pop up.
- While this overlay is active, none of the other charts will work.
- Simply clicking anywhere on the window will allow the user to exit this overlay.
- The text on this overlay does the storytelling.



Evaluation

- We learned that it is certainly worthwhile to investigate our hypothesis more using data before 2010. Although we make a reasonable case, our hypothesis can be solidified further. We can use the same visualizations to achieve this. This is something definitely scalable.
- The heatmap on the court is the centerpiece. This is something we did not do for homework in class. It is a custom visualization that was harder to code. We can make the heatmap look more nicer by filling out the empty spaces, or using hexagons, for instance.
- We added pictures to our visualizations. We find that having pictures makes something definitely more fun to look at.
- Everything apart from the above 2, we did in class. We did assignments on interaction, linecharts, tooltips and overlays and they came in handy.

THANK YOU!!!