

## MOOC 1 Week 3 Assignment, part Ic

As usual, we begin by importing the packages we will need

```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --
## v ggplot2 3.3.2      v purrr  0.3.4
## v tibble  3.0.3      v dplyr  1.0.0
## v tidyr   1.1.0      v stringr 1.4.0
## v readr   1.3.1      v forcats 0.5.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

library(patchwork)
```

The data consists of the shot log for the NBA season 2016/17

```
shot = read.csv("~/Google Drive/Sports Analytics Moocs/MOOC 1 - Foundations of sports analytics/Assignment 1/shot_log.csv")
colnames(shot)

## [1] "self_previous_shot"      "player_position"         "home_game"
## [4] "location_x"              "opponent_previous_shot"  "home_team"
## [7] "shot_type"               "points"                  "away_team"
## [10] "location_y"              "time"                    "date"
## [13] "shoot_player"            "time_from_last_shot"     "quarter"
## [16] "current_shot_outcome"

summary(shot)

## self_previous_shot player_position home_game location_x
## Length:210072      Length:210072      Length:210072      Min. : 0.0
## Class :character   Class :character   Class :character   1st Qu.: 94.0
## Mode :character    Mode :character    Mode :character    Median :342.0
##                                     Mean :468.5
##                                     3rd Qu.:843.0
##                                     Max. :933.0
##                                     NA's :397
## opponent_previous_shot home_team shot_type points
## Length:210072          Length:210072      Length:210072      Min. :2.000
## Class :character       Class :character   Class :character   1st Qu.:2.000
## Mode :character        Mode :character    Mode :character    Median :2.000
##                                     Mean :2.316
##                                     3rd Qu.:3.000
##                                     Max. :3.000
##
```

```
## away_team location_y time date
## Length:210072 Min. : 0.0 Length:210072 Length:210072
## Class :character 1st Qu.:197.0 Class :character Class :character
## Mode :character Median :250.0 Mode :character Mode :character
## Mean :249.4
## 3rd Qu.:303.0
## Max. :500.0
## NA's :397
## shoot_player time_from_last_shot quarter current_shot_outcome
## Length:210072 Min. : 0.00 Min. :1.00 Length:210072
## Class :character 1st Qu.: 22.00 1st Qu.:1.00 Class :character
## Mode :character Median : 31.00 Median :2.00 Mode :character
## Mean : 33.28 Mean :2.48
## 3rd Qu.: 41.00 3rd Qu.:3.00
## Max. :255.00 Max. :8.00
## NA's :10000
```

```
unique(shot$shoot_player)
```

```
## [1] "Kent Bazemore" "Dwight Howard"
## [3] "Kyle Korver" "Dennis Schroder"
## [5] "Paul Millsap" "Tim Hardaway Jr."
## [7] "Mike Muscala" "Malcolm Delaney"
## [9] "Thabo Sefolosha" "Kris Humphries"
## [11] "DeAndre' Bembry" "Taurean Prince"
## [13] "Walter Tavares" "Ryan Kelly"
## [15] "Mike Scott" "Mike Dunleavy"
## [17] "Gary Neal" "Lamar Patterson"
## [19] "Ersan Ilyasova" "Jose Calderon"
## [21] "Jae Crowder" "Al Horford"
## [23] "Avery Bradley" "Isaiah Thomas"
## [25] "Jaylen Brown" "Terry Rozier"
## [27] "Amir Johnson" "Jonas Jerebko"
## [29] "Gerald Green" "Tyler Zeller"
## [31] "Jordan Mickey" "Marcus Smart"
## [33] "James Young" "Demetrius Jackson"
## [35] "Kelly Olynyk" "Brook Lopez"
## [37] "Bojan Bogdanovic" "Jeremy Lin"
## [39] "Rondae Hollis-Jefferson" "Joe Harris"
## [41] "Luis Scola" "Sean Kilpatrick"
## [43] "Justin Hamilton" "Greivis Vasquez"
## [45] "Trevor Booker" "Chris McCullough"
## [47] "Anthony Bennett" "Isaiah Whitehead"
## [49] "Randy Foye" "Yogi Ferrell"
## [51] "Caris Levert" "Spencer Dinwiddie"
## [53] "Quincy Acy" "KJ McDaniels"
## [55] "Andrew Nicholson" "Archie Goodwin"
## [57] "Michael Kidd-Gilchrist" "Kemba Walker"
## [59] "Roy Hibbert" "Marvin Williams"
## [61] "Marco Belinelli" "Cody Zeller"
## [63] "Spencer Hawes" "Ramon Sessions"
## [65] "Jeremy Lamb" "Nicolas Batum"
## [67] "Frank Kaminsky" "Treveon Graham"
## [69] "Brian Roberts" "Christian Wood"
## [71] "Aaron Harrison" "Miles Plumlee"
```

## [73]	"Mike Tobey"	"Johnny O'Bryant III"
## [75]	"Briante Weber"	"Dwyane Wade"
## [77]	"Taj Gibson"	"Rajon Rondo"
## [79]	"Robin Lopez"	"Jimmy Butler"
## [81]	"Doug McDermott"	"Isaiah Canaan"
## [83]	"Nikola Mirotic"	"Cristiano Felicio"
## [85]	"Michael Carter-Williams"	"Bobby Portis"
## [87]	"Denzel Valentine"	"Paul Zipser"
## [89]	"Jerian Grant"	"RJ Hunter"
## [91]	"Cameron Payne"	"Joffrey Lauvergne"
## [93]	"Anthony Morrow"	"Kevin Love"
## [95]	"LeBron James"	"Kyrie Irving"
## [97]	"J.R. Smith"	"Tristan Thompson"
## [99]	"Richard Jefferson"	"Iman Shumpert"
## [101]	"Channing Frye"	"DeAndre Liggins"
## [103]	"James Jones"	"Jordan McRae"
## [105]	"Chris Andersen"	"Kay Felder"
## [107]	"Derrick Williams"	"Deron Williams"
## [109]	"Larry Sanders"	"Dirk Nowitzki"
## [111]	"Harrison Barnes"	"Andrew Bogut"
## [113]	"Wesley Matthews"	"Seth Curry"
## [115]	"Dwight Powell"	"J.J. Barea"
## [117]	"Justin Anderson"	"Salah Mejri"
## [119]	"Nicolas Brussino"	"Dorian Finney-Smith"
## [121]	"A.J. Hammons"	"Jonathan Gibson"
## [123]	"Devin Harris"	"Pierre Jackson"
## [125]	"Nerlens Noel"	"Quinn Cook"
## [127]	"Ben Bentil"	"Manny Harris"
## [129]	"Jarrod Uthoff"	"Nikola Jokic"
## [131]	"Danilo Gallinari"	"Jusuf Nurkic"
## [133]	"Emmanuel Mudiay"	"Will Barton"
## [135]	"Wilson Chandler"	"Jameer Nelson"
## [137]	"Jamal Murray"	"Kenneth Faried"
## [139]	"Darrell Arthur"	"Juancho Hernangomez"
## [141]	"Gary Harris"	"Malik Beasley"
## [143]	"Jarnell Stokes"	"Mike Miller"
## [145]	"Alonzo Gee"	"Mason Plumlee"
## [147]	"Kentavious Caldwell-Pope"	"Marcus Morris"
## [149]	"Tobias Harris"	"Andre Drummond"
## [151]	"Ish Smith"	"Aron Baynes"
## [153]	"Jon Leuer"	"Stanley Johnson"
## [155]	"Beno Udrih"	"Boban Marjanovic"
## [157]	"Henry Ellenson"	"Michael Gbinije"
## [159]	"Darrun Hilliard"	"Reggie Bullock"
## [161]	"Reggie Jackson"	"Draymond Green"
## [163]	"Kevin Durant"	"Klay Thompson"
## [165]	"Stephen Curry"	"Ian Clark"
## [167]	"David West"	"Shaun Livingston"
## [169]	"Andre Iguodala"	"Zaza Pachulia"
## [171]	"Patrick McCaw"	"JaVale McGee"
## [173]	"Kevon Looney"	"James Michael McAdoo"
## [175]	"Anderson Varejao"	"Damian Jones"
## [177]	"Matt Barnes"	"Ryan Anderson"
## [179]	"Trevor Ariza"	"James Harden"

## [181]	"Eric Gordon"	"Nene Hilario"
## [183]	"Clint Capela"	"Sam Dekker"
## [185]	"Corey Brewer"	"Tyler Ennis"
## [187]	"Bobby Brown"	"Montrezl Harrell"
## [189]	"Kyle Wiltjer"	"Patrick Beverley"
## [191]	"Chinanu Onuaku"	"Lou Williams"
## [193]	"Troy Williams"	"Isaiah Taylor"
## [195]	"Myles Turner"	"Thaddeus Young"
## [197]	"Monta Ellis"	"Paul George"
## [199]	"Jeff Teague"	"Lavoy Allen"
## [201]	"Al Jefferson"	"Rodney Stuckey"
## [203]	"Glenn Robinson III"	"CJ Miles"
## [205]	"Joe Young"	"Kevin Seraphin"
## [207]	"George Niang"	"Rakeem Christmas"
## [209]	"Aaron Brooks"	"Lance Stephenson"
## [211]	"Chris Paul"	"JJ Redick"
## [213]	"Blake Griffin"	"DeAndre Jordan"
## [215]	"Jamal Crawford"	"Raymond Felton"
## [217]	"Austin Rivers"	"Marreese Speights"
## [219]	"Wesley Johnson"	"Luc Mbah a Moute"
## [221]	"Diamond Stone"	"Brandon Bass"
## [223]	"Alan Anderson"	"Paul Pierce"
## [225]	"Brice Johnson"	"Julius Randle"
## [227]	"Timofey Mozgov"	"D'Angelo Russell"
## [229]	"Luol Deng"	"Nick Young"
## [231]	"Jordan Clarkson"	"Brandon Ingram"
## [233]	"Larry Nance Jr."	"Tarik Black"
## [235]	"Marcelo Huertas"	"Thomas Robinson"
## [237]	"Metta World Peace"	"Ivica Zubac"
## [239]	"David Nwaba"	"JaMychal Green"
## [241]	"Marc Gasol"	"Mike Conley"
## [243]	"Andrew Harrison"	"James Ennis III"
## [245]	"Wade Baldwin IV"	"Zach Randolph"
## [247]	"Vince Carter"	"Troy Daniels"
## [249]	"Jarell Martin"	"Elliott Williams"
## [251]	"Tony Allen"	"Deyonta Davis"
## [253]	"Chandler Parsons"	"Toney Douglas"
## [255]	"Brandan Wright"	"Wayne Selden"
## [257]	"Justise Winslow"	"Hassan Whiteside"
## [259]	"Luke Babbitt"	"Dion Waiters"
## [261]	"Goran Dragic"	"Tyler Johnson"
## [263]	"James Johnson"	"Willie Reed"
## [265]	"Rodney McGruder"	"Udonis Haslem"
## [267]	"Josh Richardson"	"Josh McRoberts"
## [269]	"Wayne Ellington"	"Okaro White"
## [271]	"Matthew Dellavedova"	"Jabari Parker"
## [273]	"Giannis Antetokounmpo"	"Michael Beasley"
## [275]	"Greg Monroe"	"Malcolm Brogdon"
## [277]	"Jason Terry"	"Mirza Teletovic"
## [279]	"John Henson"	"Rashad Vaughn"
## [281]	"Tony Snell"	"Thon Maker"
## [283]	"Steve Novak"	"Khris Middleton"
## [285]	"Axel Toupane"	"Terrence Jones"
## [287]	"Gary Payton II"	"Karl-Anthony Towns"

## [289]	"Andrew Wiggins"	"Zach LaVine"
## [291]	"Gorgui Dieng"	"Ricky Rubio"
## [293]	"Nemanja Bjelica"	"Kris Dunn"
## [295]	"Brandon Rush"	"Shabazz Muhammad"
## [297]	"Cole Aldrich"	"Tyus Jones"
## [299]	"Jordan Hill"	"John Lucas III"
## [301]	"Adreian Payne"	"Omri Casspi"
## [303]	"E'Twaun Moore"	"Anthony Davis"
## [305]	"Tim Frazier"	"Omer Asik"
## [307]	"Solomon Hill"	"Buddy Hield"
## [309]	"Alexis Ajinca"	"Langston Galloway"
## [311]	"Dante Cunningham"	"Cheick Diallo"
## [313]	"Jrue Holiday"	"Anthony Brown"
## [315]	"Reggie Williams"	"Tyreke Evans"
## [317]	"Donatas Motiejunas"	"DeMarcus Cousins"
## [319]	"Hollis Thompson"	"Jarrett Jack"
## [321]	"Jordan Crawford"	"Derrick Rose"
## [323]	"Carmelo Anthony"	"Kristaps Porzingis"
## [325]	"Courtney Lee"	"Joakim Noah"
## [327]	"Brandon Jennings"	"Lance Thomas"
## [329]	"Kyle O'Quinn"	"Justin Holiday"
## [331]	"Guillermo Hernangomez"	"Mindaugas Kuzminskas"
## [333]	"Ron Baker"	"Sasha Vujacic"
## [335]	"Maurice Ndour"	"Marshall Plumlee"
## [337]	"Chasson Randle"	"Russell Westbrook"
## [339]	"Victor Oladipo"	"Steven Adams"
## [341]	"Andre Roberson"	"Domantas Sabonis"
## [343]	"Kyle Singler"	"Semaj Christon"
## [345]	"Enes Kanter"	"Alex Abrines"
## [347]	"Jerami Grant"	"Nick Collison"
## [349]	"Josh Huestis"	"Norris Cole"
## [351]	"Evan Fournier"	"Nikola Vucevic"
## [353]	"Aaron Gordon"	"Serge Ibaka"
## [355]	"Elfrid Payton"	"Jeff Green"
## [357]	"Mario Hezonja"	"D.J. Augustin"
## [359]	"Bismack Biyombo"	"CJ Wilcox"
## [361]	"CJ Watson"	"Stephen Zimmerman"
## [363]	"Damjan Rudez"	"Arinze Onuaku"
## [365]	"Jodie Meeks"	"Terrence Ross"
## [367]	"Marcus Georges-Hunt"	"Patricio Garino"
## [369]	"Joel Embiid"	"Gerald Henderson"
## [371]	"Dario Saric"	"Sergio Rodriguez"
## [373]	"Jahlil Okafor"	"Richaun Holmes"
## [375]	"Robert Covington"	"Nik Stauskas"
## [377]	"TJ McConnell"	"Timothe Luwawu-Cabarrot"
## [379]	"Jerryd Bayless"	"Justin Harper"
## [381]	"Shawn Long"	"Tiago Splitter"
## [383]	"Alex Poythress"	"Jared Dudley"
## [385]	"Devin Booker"	"Tyson Chandler"
## [387]	"Eric Bledsoe"	"TJ Warren"
## [389]	"Alex Len"	"Brandon Knight"
## [391]	"Leandro Barbosa"	"Marquese Chriss"
## [393]	"Tyler Ulis"	"Dragan Bender"
## [395]	"P.J. Tucker"	"Alan Williams"

```
## [397] "John Jenkins"           "Derrick Jones, Jr."
## [399] "Ronnie Price"            "Jarell Eddie"
## [401] "Elijah Millsap"         "Al-Farouq Aminu"
## [403] "Damian Lillard"         "CJ McCollum"
## [405] "Allen Crabbe"           "Ed Davis"
## [407] "Evan Turner"            "Noah Vonleh"
## [409] "Maurice Harkless"       "Meyers Leonard"
## [411] "Jake Layman"            "Shabazz Napier"
## [413] "Tim Quarterman"         "Pat Connaughton"
## [415] "Ty Lawson"              "Kosta Koufos"
## [417] "Arron Afflalo"          "Rudy Gay"
## [419] "Anthony Tolliver"       "Garrett Temple"
## [421] "Ben McLemore"           "Willie Cauley-Stein"
## [423] "Malachi Richardson"     "Jordan Farmar"
## [425] "Skal Labissiere"        "Georgios Papagiannis"
## [427] "Darren Collison"        "LaMarcus Aldridge"
## [429] "Tony Parker"            "Pau Gasol"
## [431] "Kawhi Leonard"          "Patty Mills"
## [433] "Jonathon Simmons"       "Manu Ginobili"
## [435] "David Lee"              "Dewayne Dedmon"
## [437] "Kyle Anderson"          "Davis Bertans"
## [439] "Nicolas Laprovittola"   "Bryn Forbes"
## [441] "Dejounte Murray"        "Danny Green"
## [443] "Joel Anthony"           "DeMar DeRozan"
## [445] "Jonas Valanciunas"      "Kyle Lowry"
## [447] "Pascal Siakam"          "Patrick Patterson"
## [449] "Cory Joseph"            "Jakob Poeltl"
## [451] "DeMarre Carroll"        "Norman Powell"
## [453] "Lucas Nogueira"         "Fred VanVleet"
## [455] "Bruno Caboclo"          "Jared Sullinger"
## [457] "Delon Wright"           "Rodney Hood"
## [459] "George Hill"            "Joe Johnson"
## [461] "Trey Lyles"             "Joe Ingles"
## [463] "Shelvin Mack"           "Rudy Gobert"
## [465] "Boris Diaw"             "Dante Exum"
## [467] "Derrick Favors"         "Joel Bolomboy"
## [469] "Jeff Withey"            "Gordon Hayward"
## [471] "Raul Neto"              "Alec Burks"
## [473] "Markieff Morris"        "John Wall"
## [475] "Bradley Beal"           "Otto Porter Jr."
## [477] "Marcin Gortat"          "Trey Burke"
## [479] "Kelly Oubre Jr."        "Marcus Thornton"
## [481] "Jason Smith"            "Daniel Ochefu"
## [483] "Sheldon McClellan"      "Tomas Satoransky"
## [485] "Ian Mahinmi"
```

```
shot$halfcourt_x = ifelse(shot$location_x < 933/2, 933 - shot$location_x, shot$location_x)
shot$halfcourt_y = ifelse(shot$location_x < 933/2, 500 - shot$location_y, shot$location_y)
summary(shot)
```

```
## self_previous_shot player_position home_game location_x
## Length:210072      Length:210072   Length:210072   Min. : 0.0
## Class :character   Class :character Class :character 1st Qu.: 94.0
## Mode :character    Mode :character  Mode :character Median :342.0
##                                     Mean :468.5
```

```
##                                     3rd Qu.:843.0
##                                     Max.    :933.0
##                                     NA's    :397
## opponent_previous_shot home_team      shot_type      points
## Length:210072          Length:210072 Length:210072 Min.    :2.000
## Class :character       Class :character Class :character 1st Qu.:2.000
## Mode  :character       Mode  :character Mode  :character Median :2.000
##                                     Mean    :2.316
##                                     3rd Qu.:3.000
##                                     Max.    :3.000
##
## away_team               location_y      time          date
## Length:210072          Min.    : 0.0 Length:210072 Length:210072
## Class :character       1st Qu.:197.0 Class :character Class :character
## Mode  :character       Median :250.0 Mode  :character Mode  :character
##                                     Mean    :249.4
##                                     3rd Qu.:303.0
##                                     Max.    :500.0
##                                     NA's    :397
## shoot_player           time_from_last_shot quarter      current_shot_outcome
## Length:210072          Min.    : 0.00 Min.    :1.00 Length:210072
## Class :character       1st Qu.: 22.00 1st Qu.:1.00 Class :character
## Mode  :character       Median : 31.00 Median :2.00 Mode  :character
##                                     Mean    : 33.28 Mean    :2.48
##                                     3rd Qu.: 41.00 3rd Qu.:3.00
##                                     Max.    :255.00 Max.    :8.00
##                                     NA's    :10000
## halfcourt_x            halfcourt_y
## Min.    :468.0 Min.    : 0.0
## 1st Qu.:720.0 1st Qu.:197.0
## Median :841.0 Median :250.0
## Mean    :799.7 Mean    :250.3
## 3rd Qu.:878.0 3rd Qu.:303.0
## Max.    :933.0 Max.    :500.0
## NA's    :397 NA's    :397
```

## Comparing players

We use a pivot table here to list players by shots

```
playersn = shot %>% group_by(shoot_player, current_shot_outcome) %>%
  summarise(count = n()) %>% arrange(shoot_player, current_shot_outcome) %>% ungroup()

## 'summarise()' regrouping output by 'shoot_player' (override with '.groups' argument)
playersn

## # A tibble: 1,419 x 3
##   shoot_player current_shot_outcome count
##   <chr>         <chr>             <int>
## 1 A.J. Hammons BLOCKED              5
## 2 A.J. Hammons MISSED             20
## 3 A.J. Hammons SCORED             17
## 4 Aaron Brooks BLOCKED             14
```

##	5	Aaron Brooks	MISSED	165
##	6	Aaron Brooks	SCORED	121
##	7	Aaron Gordon	BLOCKED	44
##	8	Aaron Gordon	MISSED	427
##	9	Aaron Gordon	SCORED	393
##	10	Aaron Harrison	MISSED	4
##	#	... with 1,409 more rows		



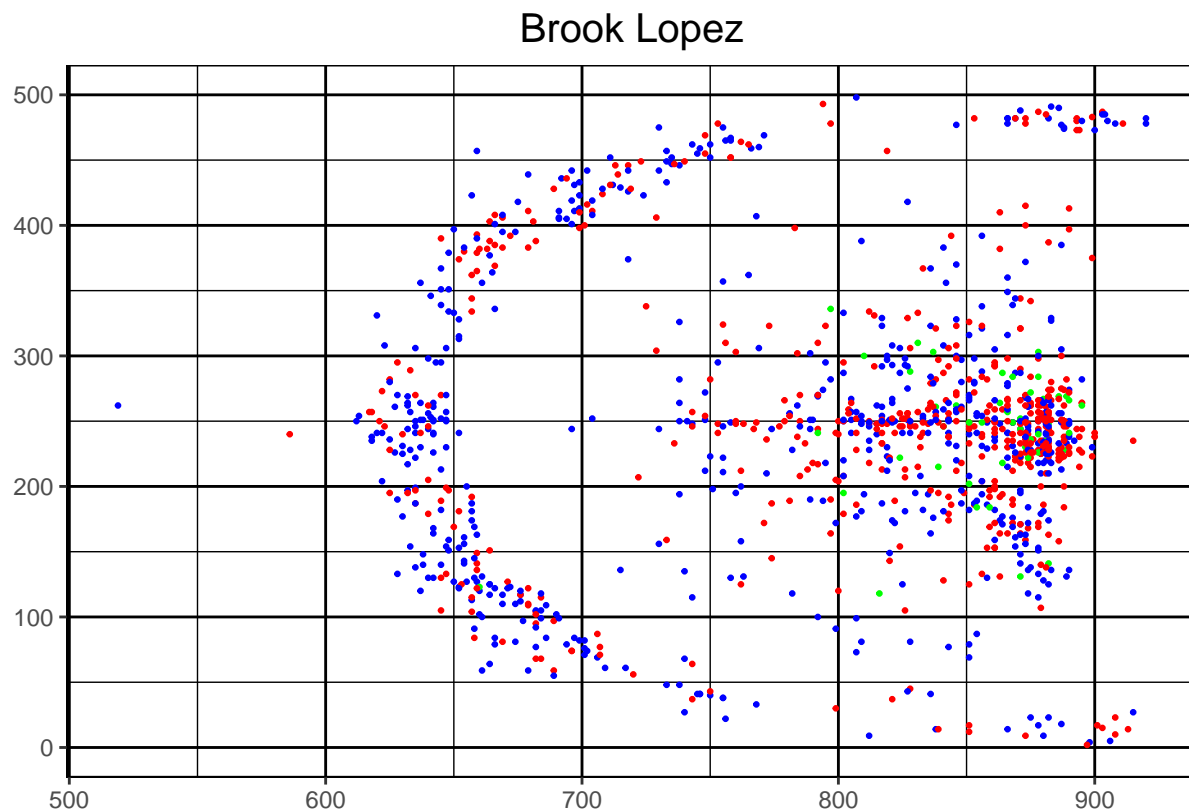
## Brook Lopez plot

```
BLopez = shot[shot$shoot_player == 'Brook Lopez', ]

hxBL = BLopez$halfcourt_x
hyBL = BLopez$halfcourt_y
colors_BLopez = ifelse(BLopez$current_shot_outcome == 'SCORED', 'red',
                       ifelse(BLopez$current_shot_outcome == 'MISSED', 'blue', 'green'))

BLopez_hxyBL <- data.frame(hxBL, hyBL, colors_BLopez)

BLopez_plot <- ggplot(data = BLopez_hxyBL, aes(x = hxBL, y = hyBL)) +
  geom_point(color = colors_BLopez, size = .5) +
  ggtitle("Brook Lopez") +
  xlab("") +
  ylab("") +
  theme(panel.background = element_rect(color = "black", fill = "white"),
        plot.title = element_text(size = 15, hjust = 0.5),
        panel.grid = element_line(color = "black", linetype = "solid", size = 0.5))
BLopez_plot
```



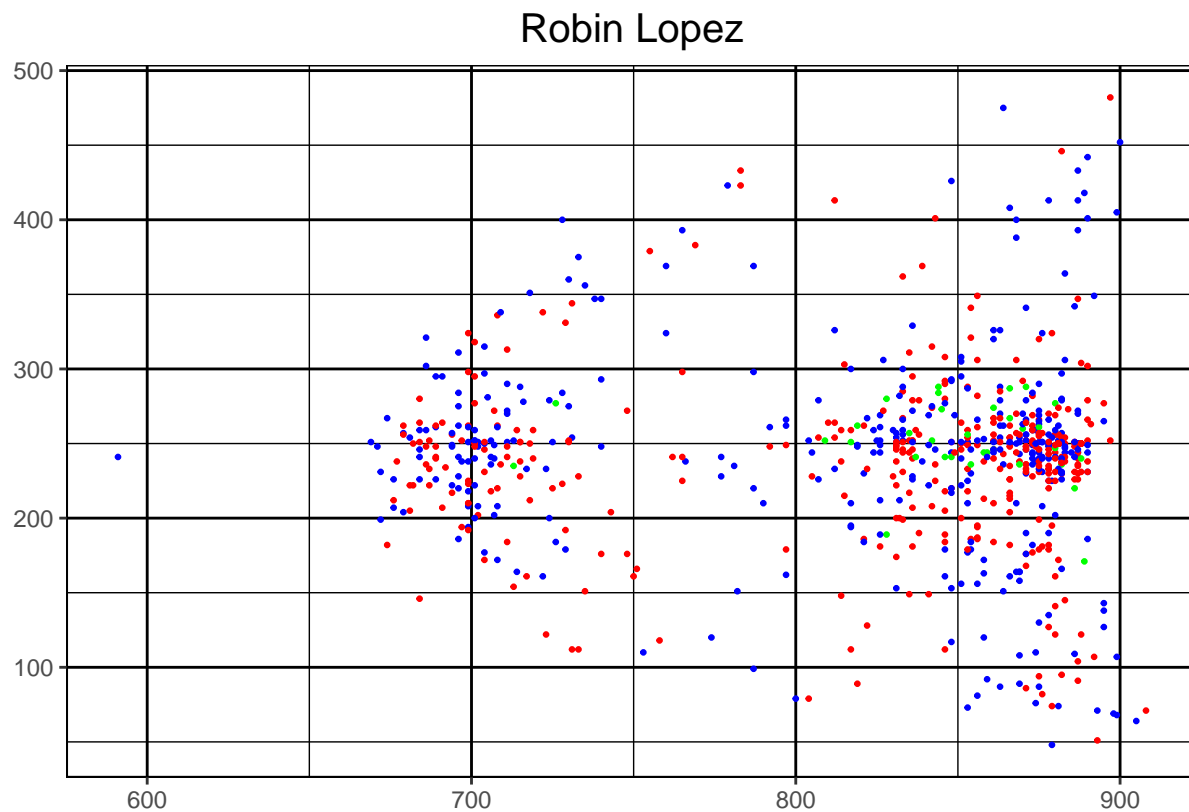
## Robin Lopez plot

```
RLopez = shot[shot$shoot_player == 'Robin Lopez', ]

hxRL = RLopez$halfcourt_x
hyRL = RLopez$halfcourt_y
colors_RLopez = ifelse(RLopez$current_shot_outcome == 'SCORED', 'red',
                       ifelse(RLopez$current_shot_outcome == 'MISSED', 'blue', 'green'))

RLopez_hxyRL <- data.frame(hxRL, hyRL, colors_RLopez)

RLopez_plot <- ggplot(data = RLopez_hxyRL, aes(x = hxRL, y = hyRL)) +
  geom_point(color = colors_RLopez, size = .5) +
  ggtitle("Robin Lopez") +
  xlab("") +
  ylab("") +
  theme(panel.background = element_rect(color = "black", fill = "white"),
        plot.title = element_text(size = 15, hjust = 0.5),
        panel.grid = element_line(color = "black", linetype = "solid", size = 0.5))
RLopez_plot
```



## Brook and Robin Lopez side by side

BLopez\_plot + RLopez\_plot

