

Accessing and Working With StatsBomb Data In R



What is R and Why Use It?

What Is R and Why Use It?

R is a programming language that is useful for managing large datasets. It is especially useful in the world of football data, as it allows us to manipulate that data to various ends. Such as creating metrics out of the data and visualising it.

R itself can be downloaded here:

<https://cran.r-project.org/mirrors.html>

We at StatsBomb use R regularly (amongst other coding languages) in day-to-day work, particularly within our analysis department. Spreadsheets are a viable route when you're just starting out, but eventually the datasets become too big and unwieldy, performing nuanced dissection of them becomes too complicated.

Once you've gotten over the learning curve, R is ideal for parsing data and working with it however you like in a fast manner.



RStudio

The base version of R is a somewhat cumbersome piece of software. This has led to the creation of many different 'IDE's (integrated development environment). These are wrappers around the initial R install that make most tasks within R easier and more manageable for the end user. The most popular of these is RStudio:

<https://www.rstudio.com/products/rstudio/>

It is recommended that you install RStudio (or any similar IDE that you find and prefer) as most users do. It will make working with StatsBomb's data a cleaner, simpler process.

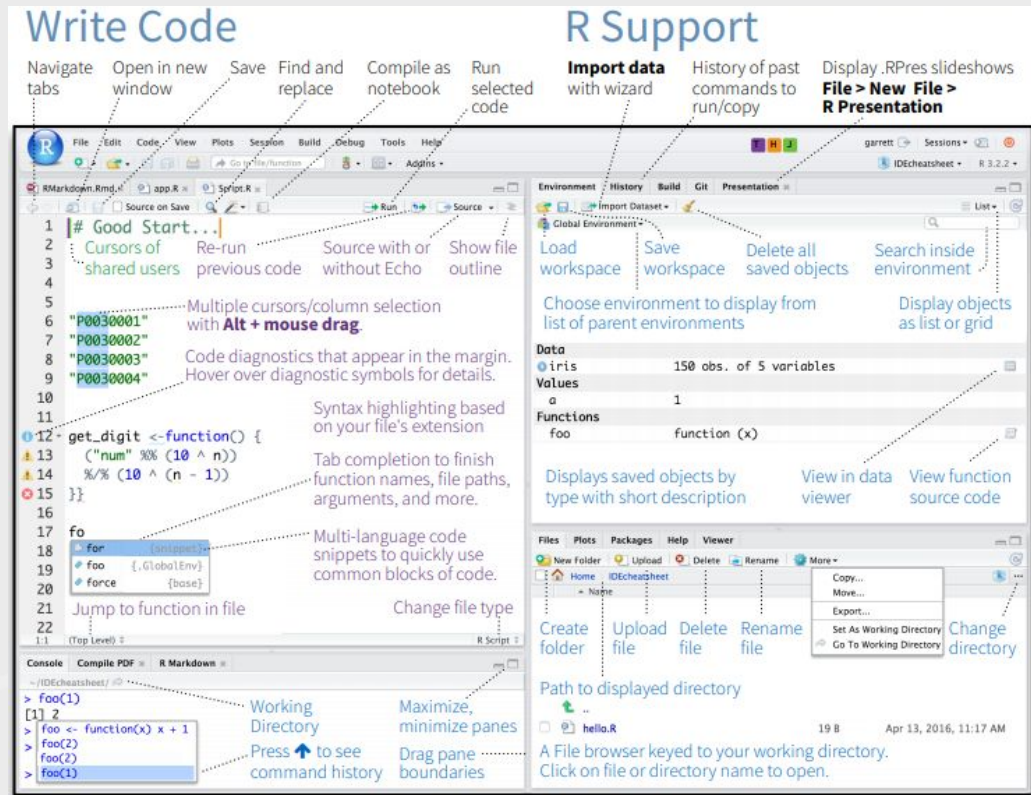


Opening a New R 'Project'

This (minus the annotations of course) is what you should see when you load up R Studio.

If you're wondering what a particular option or section of R Studio does, then there's a handy set of cheat sheets for it and many other R-related subjects at <https://www.rstudio.com/resources/cheatsheets/>.

There are a well of resources out there with detailed answers to just about any question you could have related to R.



Packages & ‘StatsBombR’

What is an R ‘Package’?

‘Packages’ are downloadable bundles of functions that make tasks easier. Most packages are installed by running `install.packages('PackageNameHere')`. However, if the package comes via Github we use the *devtools* package to install it (this includes StatsBombR, which we will walk through installing on the next page).

The main packages we will focus on here and which need installing are:

‘tidyverse’: tidyverse contains a whole host of other packages (such as dplyr and magrittr) that are useful for manipulating data. `install.packages("tidyverse")`

‘devtools’: Most packages are hosted on [CRAN](https://cran.r-project.org/). However there are also countless useful ones hosted on Github. Devtools allows for downloading of packages directly from Github. `install.packages("devtools")`

‘ggplot2’: The most popular package for visualising data within R. It is contained within tidyverse.

‘StatsBombR’: This is StatsBomb’s own package for parsing our data.

Once a package is installed it can be loaded into R by running `library(PackageNameHere)`. You should load all of these at the start of any session.



What is 'StatsBombR' and how to Install it?

StatsBomb's former data scientist Derrick Yam created 'StatsBombR', an R package dedicated to making using StatBomb's data in R much easier. It can be found on Github at the following link, along with much more information on its uses. There are lots of helpful functions within it that you should get to know.

<https://github.com/statsbomb/StatsBombR>

To install the package in R, you'll need to install the 'Devtools' package, which can be done by running the following line of code:

```
install.packages("devtools")
```

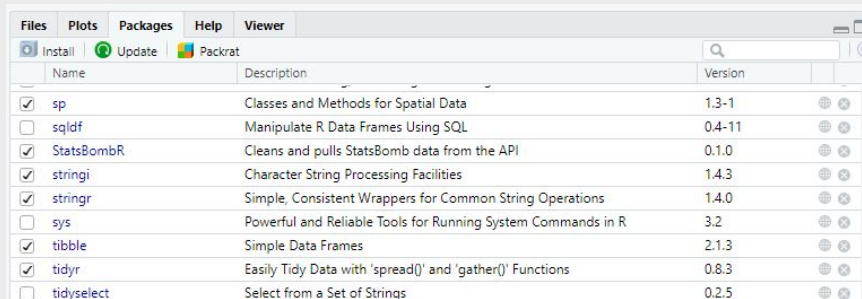
Then, to install StatsBombR itself, run:

```
devtools::install_github("statsbomb/StatsBombR")
```



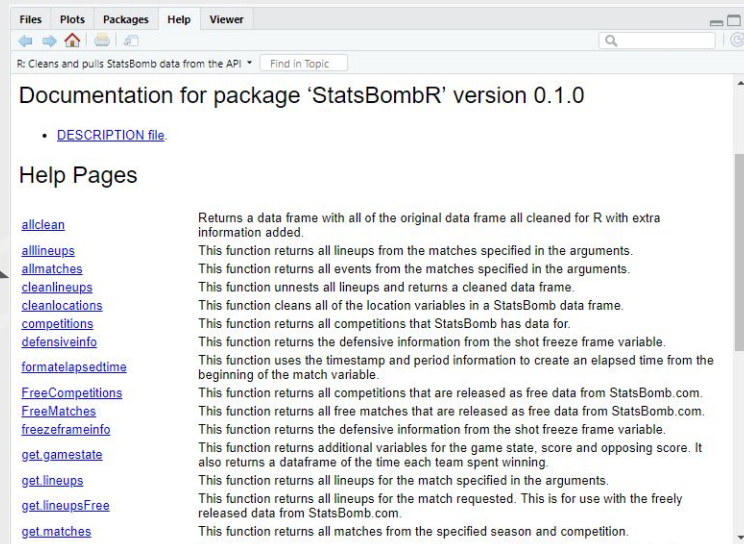
STATSBOMB  **R**

Finding More Info On Packages



Files	Plots	Packages	Help	Viewer
Install	Update	Packrat		
Name	Description	Version		
<input checked="" type="checkbox"/> sp	Classes and Methods for Spatial Data	1.3-1		
<input type="checkbox"/> sqldf	Manipulate R Data Frames Using SQL	0.4-11		
<input checked="" type="checkbox"/> StatsBombR	Cleans and pulls StatsBomb data from the API	0.1.0		
<input checked="" type="checkbox"/> stringi	Character String Processing Facilities	1.4.3		
<input checked="" type="checkbox"/> stringr	Simple, Consistent Wrappers for Common String Operations	1.4.0		
<input type="checkbox"/> sys	Powerful and Reliable Tools for Running System Commands in R	3.2		
<input checked="" type="checkbox"/> tibble	Simple Data Frames	2.1.3		
<input checked="" type="checkbox"/> tidyr	Easily Tidy Data with 'spread()' and 'gather()' Functions	0.8.3		
<input type="checkbox"/> tidyselect	Select from a Set of Strings	0.2.5		

If you want more detail on the various functions within a package then click on the package's name in the viewer in the bottom right. That will take you to the documentation for that package. It should contain all sorts of information on the ins and outs of its functions.



Files Plots Packages Help Viewer

R: Cleans and pulls StatsBomb data from the API Find in Topic

Documentation for package 'StatsBombR' version 0.1.0

- [DESCRIPTION file.](#)

Help Pages

allclean	Returns a data frame with all of the original data frame all cleaned for R with extra information added.
alllineups	This function returns all lineups from the matches specified in the arguments.
allmatches	This function returns all events from the matches specified in the arguments.
cleanlineups	This function unnests all lineups and returns a cleaned data frame.
cleanlocations	This function cleans all of the location variables in a StatsBomb data frame.
competitions	This function returns all competitions that StatsBomb has data for.
defensiveinfo	This function returns the defensive information from the shot freeze frame variable.
formatelapsedtime	This function uses the timestamp and period information to create an elapsed time from the beginning of the match variable.
FreeCompetitions	This function returns all competitions that are released as free data from StatsBomb.com.
FreeMatches	This function returns all free matches that are released as free data from StatsBomb.com.
freezeframeinfo	This function returns the defensive information from the shot freeze frame variable.
get_gamestate	This function returns additional variables for the game state, score and opposing score. It also returns a dataframe of the time each team spent winning.
get_lineups	This function returns all lineups for the match specified in the arguments.
get_lineupsFree	This function returns all lineups for the match requested. This is for use with the freely released data from StatsBomb.com.
get_matches	This function returns all matches from the specified season and competition.



Pulling in StatsBomb Data

Key Functions for Getting the Free Data

There are several key functions within StatsBombR to familiarise yourself with for bringing StatsBomb Data into R.

FreeCompetitions() - This shows you all the competitions that are available as free data

If you want to store the output of this (or any other functions) so you can pull it up at any time, instead of just having it in the R console, you can run something like the following:

Comp <- *FreeCompetitions()*. Then, anytime you run *Comp* (or whatever word you choose to store it under, you can go with anything), you will see the output of *FreeCompetitions()*.

Matches* <- *FreeMatches(Comp) - This shows the available matches within the competitions chosen

StatsBombData* <- *StatsBombFreeEvents(MatchesDF = Matches, Parallel = T) - This pulls all the event data for the matches that are chosen.



Pulling the Free Data

Now we're going to run through an example of how to pull the data into R. Open up a new 'script', so we can store this code and have it easily accessible, by going to **File -> New File -> R Script**. This script can be saved at any time.

```
library(tidyverse)  
library(StatsBombR)1
```

```
Comp <- FreeCompetitions() %>%  
filter(competition_id==11 & season_name=="2005/2006")2
```

```
Matches <- FreeMatches(Comp)3
```

```
StatsBombData <- StatsBombFreeEvents(MatchesDF = Matches, Parallel = T)4
```

```
StatsBombData = allclean(StatsBombData)5
```

⁴: Now we have created a 'dataframe' (essentially a table) called 'StatsBombData' (or whatever you choose to call it) of the free event data for the La Liga season in 2005/2006.

¹: *tidyverse* loads many different packages. Most important for this task are *dplyr* and *magrittr*. *StatsBombR* loads *StatsBombR*.

²: This grabs the competitions that are available to the user and filters it down, using *dplyr*'s 'filter' function, to just the 2005/06 La Liga season in this example.

³: This pulls all the matches for the desired competition.

⁵: Extracts lots of relevant information such as x/y coordinates. More information can be found in the package info. Be sure to familiarise yourself with the columns it creates using *names(nameofyourdfhere)*.



Working With the Data

Getting to Know the Data

On our Github page - where our free data is hosted - we have put the specification documents for StatsBomb Data. These are available to view or download at any time and will hopefully answer any questions you may have about what a certain event type is or any similar inquiries.

These documents include:

[Open Data Competitions v2.0.0.pdf](#) - Covers the objects contained within the competitions information (*FreeCompetitions()*).

[Open Data Matches v3.0.0.pdf](#) - Describes the match info download (*FreeMatches()*).

[Open Data Lineups v2.0.0.pdf](#) - Describes the structure of the lineup info (*getlineupsFree()*).

[Open Data Events v4.0.0.pdf](#) - Explains the meaning of the column names within the event data.

[StatsBomb Event Data Specification v1.1.pdf](#) - The full breakdown of all the events within the data.



Data Use Cases

Now that we have our StatsBombData file, we're going to run through some ways you can use the data and familiarise yourself with R in the process. There will be four use cases, increasing in complexity as they go:

Use Case 1: Shots and Goals - A simple but important starting point. Here we will extract shots and goals totals for each team, then look at how to do the same but on a per game basis.

Use Case 2: Graphing Shots On a Chart - After we have the shots and goals data, how can we take that and create a starter chart from it?

Use Case 3: Player Shots Per 90 - Getting shots for players is simple enough after doing so for teams. But then how can we adjust those figures on a per 90 basis?

Use Case 4: Mapping Passes - Filtering our data down to just a subset of passes and then using R's ggplot2 to plot those passes on a pitch.



Data Use Case 1: Goals and Shots

```
shots_goals = StatsBombData %>%  
  group_by(team.name) %>%1  
  summarise(shots = sum(type.name=="Shot", na.rm = TRUE),  
  goals = sum(shot.outcome.name=="Goal", na.rm = TRUE))2
```

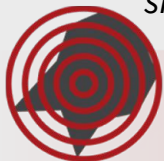
Let's break that down bit by bit:

¹: This code groups the data by team, so that whatever operation we perform on it will be done on a team by team basis. I.e, we will find the shots and goals for every team one by one.

²: *Summarise* takes whatever operation we give it and produces a new, separate table out of it. The vast majority of *summarise* uses come after *group_by*.

shots = sum(type.name=="Shot", na.rm = TRUE) is telling it to create a new column called 'shots' that sums up all the rows under the 'type.name' column that contain the word "Shot". *na.rm = TRUE* tells it to ignore any NAs within that column.

shot.outcome.name=="Goal", na.rm = TRUE) does the same but for goals.



Data Use Case 1: Goals and Shots

You should now have a table that looks like this.

If we want to do this same calculation but on a per game basis, we can change it to:

```
shots_goals = StatsBombData %>%  
  group_by(team.name) %>%  
  summarise(shots = sum(type.name=="Shot", na.rm =  
    TRUE)/n_distinct(match_id),  
    goals = sum(shot.outcome.name=="Goal", na.rm =  
    TRUE)/n_distinct(match_id))
```

Adding in the `'/n_distinct(match_id)'` means we are dividing the number of shots/goals by each distinct (or unique) instance of a match, for every team. I.e, we are dividing the numbers per game.

Totals

team.name	shots	goals
Chelsea LFC	392	38
Manchester City WFC	389	51
Arsenal WFC	373	68
Reading WFC	295	31
Birmingham City WFC	254	25
Everton LFC	230	14
West Ham United LFC	217	25
Brighton & Hove Albion WFC	207	16
Liverpool WFC	177	17
Bristol City WFC	153	15
Yeovil Town LFC	129	10

Per Game

team.name	shots	goals
Chelsea LFC	20.631579	2.0000000
Manchester City WFC	19.450000	2.5500000
Arsenal WFC	18.650000	3.4000000
Reading WFC	14.750000	1.5500000
Birmingham City WFC	13.368421	1.3157895
Everton LFC	12.105263	0.7368421
Brighton & Hove Albion WFC	10.894737	0.8421053
West Ham United LFC	10.850000	1.2500000
Liverpool WFC	9.315789	0.8947368
Bristol City WFC	7.650000	0.7500000
Yeovil Town LFC	6.789474	0.5263158



Data Use Case 2: From Data to a Chart

```
library(ggplot2)
```

```
ggplot(data = shots_goals, aes(x = reorder(team.name, shots), y = shots))1 +  
  geom_bar(stat = "identity", width = 0.5)2 +  
  labs(y = "Shots")3 +  
  theme(axis.title.y = element_blank())4 +  
  scale_y_continuous(expand = c(0,0))5 +  
  coord_flip()6 +  
  theme_SB()7
```

¹ : Here we are telling ggplot what data we are using and what we want to plot on the x/y axes of our chart. 'Reorder' quite literally reorders the team names according to the number of shots they have.

³ : This relabels the shots axis.

⁴ : This removes the title for the axis.

⁶ : This flips the entire plot, with the bars now going horizontally instead.

² : Now we are telling ggplot to format it is a bar chart.

⁵ : Here we cut down on the space between the bars and the edge of the plot

⁷ : `theme_SB()` is our own internal visual aesthetic for ggplot charts that we have packaged with StatsBombR. Optional of course.



Data Use Case 2: From Data to a Chart

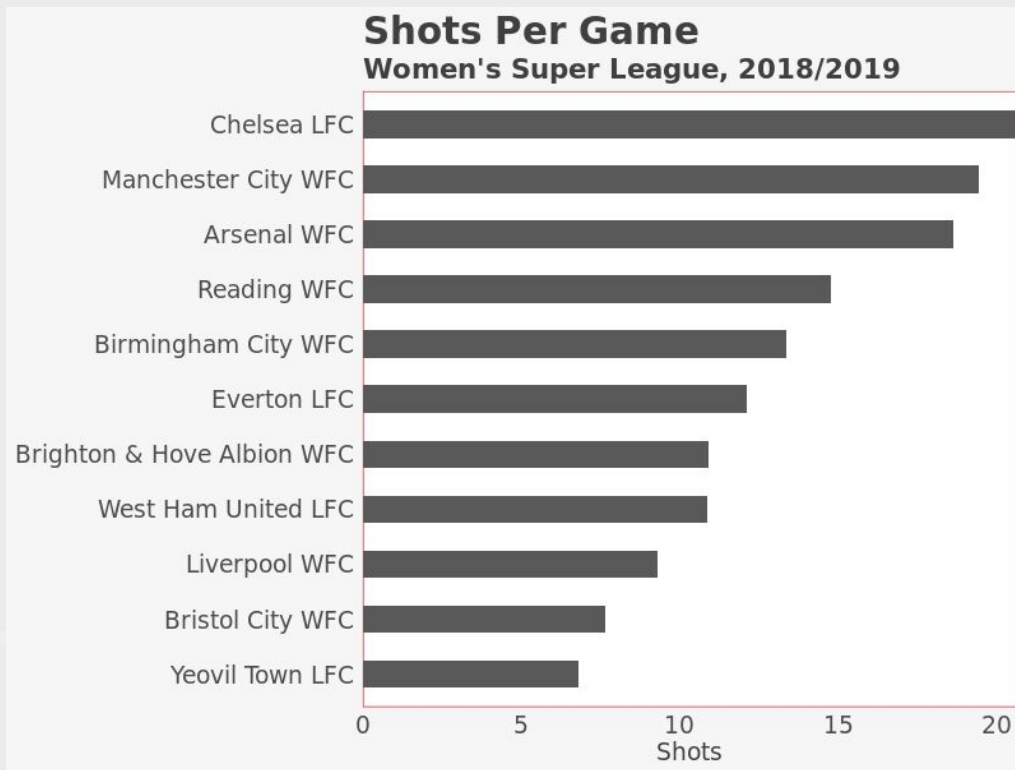
All that should result in a chart like this.

Of course this is a basic chart, fairly visually plain on its own and it could be altered in many ways to add your own spin on it.

Almost every element of a ggplot chart - from the text to the plotted data itself and beyond - can be changed how you see fit. There's lots of room for creativity.

For an in depth reference point on what kind of charts you can create or how you can modify them, you can look here:

<https://ggplot2.tidyverse.org/reference/>



Data Use Case 3: Player Shots Per 90

```
player_shots = StatsBombData %>%  
  group_by(player.name, player.id) %>%  
  summarise(shots = sum(type.name=="Shot", na.rm = TRUE)) 1
```

```
player_minutes = get.minutesplayed(StatsBombData) 2
```

```
player_minutes = player_minutes %>%  
  group_by(player.id) %>%  
  summarise(minutes = sum(MinutesPlayed)) 3
```

```
player_shots = left_join(player_shots, player_minutes) 4
```

```
player_shots = player_shots %>% mutate(nineties = minutes/90) 5
```

```
player_shots = player_shots %>% mutate(shots_per90 = shots/nineties) 6
```

¹: Much the same as the team calculation. We are including 'player.id' here as it will be important later.

²: This function gives us the minutes played in each match by ever player in the dataset.

³: Now we group that by player and sum it altogether to get their total minutes played.

⁴: `left_join` allows us to combine our shots table and our minutes table, with the the player.id acting as a reference point.

⁵: `mutate` is a dplyr function that creates a new column. In this instance we are creating a column that divides the minutes totals by 90, giving us each player's number of 90s played for the season.

⁶: Finally we divide our shots totals by our number of 90s to get our shots per 90s column.



Data Use Case 3: Player Shots Per 90

Now you'll have shots per 90 for all the players across the WSL (or your league of choice). This can be cleaned up using dplyr's 'filter' function, in order to get rid of the players with few minutes played.

This same process can of course be applied to all sorts of events with StatsBomb Data. Certain types of passes, defensive actions and so on.

player.name	player.id	shots	minutes	nineties	shots_per90
Vivianne Miedema	15623	112	1881.406033	20.90451148	5.35769516
Missy Bo Kearns	24237	1	18.450033	0.20500037	4.87803997
Pauline Bremer	20725	7	131.822717	1.46469685	4.77914593
Francesca Kirby	4641	54	1027.349783	11.41499759	4.73061861
Georgia Stanway	4643	71	1410.878733	15.67643037	4.52909229
Bethany England	15550	51	1053.991783	11.71101981	4.35487266
Jordan Nobbs	10192	35	738.513717	8.20570796	4.26532362
Danielle Carter	24281	5	105.765800	1.17517556	4.25468346
Ellen White	10180	31	689.171150	7.65745722	4.04834126
Nikita Parris	4654	74	1705.892717	18.95436352	3.90411421
Fara Williams	10251	76	1848.079417	20.53421574	3.70113965
Erin Cuthbert	4660	54	1392.178833	15.46865370	3.49093082
Nadia Nadim	4650	7	183.808083	2.04231204	3.42748800
Janine Beckie	4992	12	323.301367	3.59223741	3.34053645
Lauren Hemp	15555	24	647.574350	7.19527056	3.33552433



Data Use Case 4: Plotting Passes

Finally, we're going to look at plotting a player's passes on a pitch. For this we of course need some sort of pitch visualization. You might want to create your own once you become more familiar with ggplot and using it for more complex purposes (there will be a flexible version that we use later in this presentation). However, handily, there are several pre-made solutions out there.

The one we'll be using here comes courtesy of [FC rStats](#). A twitter user who has put together various helpful, public R packages for parsing football data. The package is called '[SBPitch](#)' and it does exactly what it says on the tin. There will be further options in the 'Other Useful Packages' at the end of this document. First let's get it installed with the following code:

```
devtools::install_github("FCrSTATS/SBpitch")
```

We're going to plot Messi's completed passes into the box for the 2005/2006 La Liga season. Plotting *all* of his passes would get messy of course, so this is a clearer subset. Make sure you've used the functions previously discussed to pull that data.



Data Use Case 4: Plotting Passes

```
library(SBpitch)
```

```
passes = messidata %>%
```

```
  filter(type.name=="Pass" & is.na(pass.type.name) & player.id==5503)1 %>%
```

```
  filter(pass.end_location.x>=102 & pass.end_location.y<=62 & pass.end_location.y>=18)2
```

```
create_Pitch() +
```

```
  geom_segment(data = passes, aes(x = location.x, y = location.y,  
    xend = pass.end_location.x, yend = pass.end_location.y),
```

```
    lineend = "round", size = 0.6, arrow = arrow(length = unit(0.08, "inches")))3 +
```

```
  labs(title = "Lionel Messi, Completed Box Passes", subtitle = "La Liga, 2005/2006")4 +
```

```
  coord_fixed(ratio = 105/100)5
```

⁴ : Creates a title and a subtitle for the plot. You can also add captions using `caption =`, along with other options.

¹ : Pull some of the Messi data of your choice and call it 'messidata' for us to work with here. Then we can filter to Messi's passes. `is.na(pass.type.name)` filters to only completed passes.

² : Filtering to passes within the box. The coordinates for pitch markings in SBD can be found in our [event spec](#).

³ : This creates an arrow from one point (location.x/y, the start part of the pass) to an end point (pass.end_location.x/y, the end of the pass). `Lineend`, `size` and `length` are all customization options for the arrow.

⁵ : Fixes the plot to a certain aspect ratio of your choice, so it doesn't look stretched.



Data Use Case 4: Plotting Passes

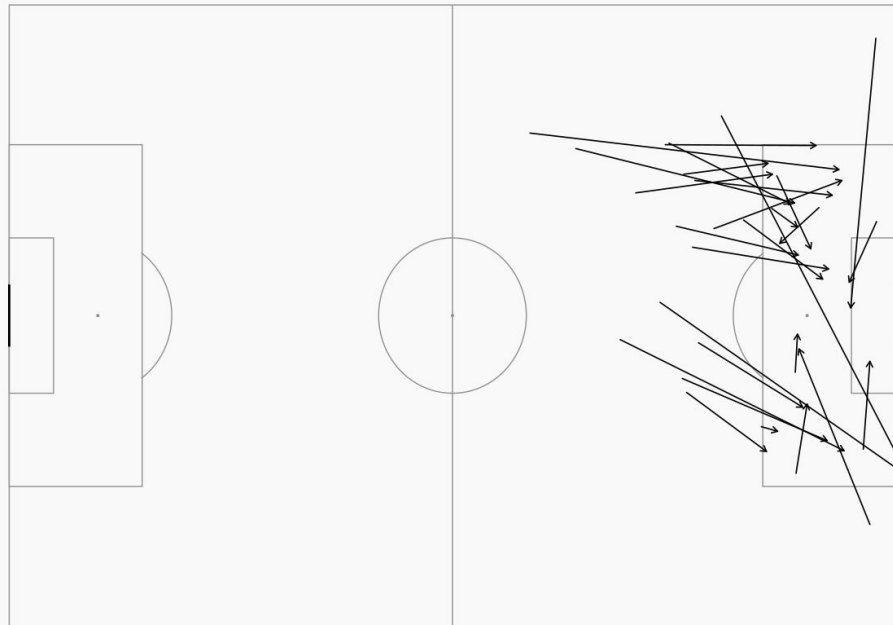
You'll have this plot. Again, it's simple and bare but it starts you off and from here you can layer on all sorts of customization.

`theme()` options allow you to change the size, placement, font and much more of the titles. As well as to alter lots of other aesthetic aspects of the plot

You can add `colour =` to `geom_segment()` in order to colour passes according to what you choose.

Again, be sure to dig into the ggplot documentation to get the full scope of how powerful it is. [This is a great cheat sheet for various ways you can use the package.](#)

Lionel Messi, Completed Box Passes
La Liga, 2005/2006



Useful StatsBombR Functions

There are all sorts of functions within StatsBombR for different purposes. You can find them all [here](#), deeper into the github page. Not all functions are related to the free data. Some are only accessible for customers via our API. Here's a quick rundown of some you may find useful:

allclean() - Mentioned previously but to elucidate: this extrapolates lots of new, helpful columns from the pre-existing columns. For example, it takes the location column and splits it up into separate x/y columns. It also extracts freeze frame data and goalkeeper information. Make sure to use.

get.playerfootedness() - Gives you a player's assumed preferred foot using our pass footedness data.

get.opposingteam() - Returns an opposing team column for each team in each match.

get.gamestate() - Returns information for how much time each team spent in various game states (winning/drawing/losing) for each match.

annotate_pitchSB() - Our own solution for plotting a pitch with ggplot.



Other Useful Packages

The community around R is packed with packages that fulfill all sorts of needs. Chances are that, if you're looking to do something in R or fix some sort of issue, there's a package out there for it. There are far too many to name but here's a brief selection of some that may be relevant to working with StatsBomb Data:

[Ben Torvaney, ggsoccer](#) - A package that contains an alternative for plotting a pitch with SB Data.

[Joe Gallagher, soccermatics](#) - Also offers an option for pitch plotting along with other useful shortcuts for creating heatmaps and so on.

[ggrepel](#) - Useful for when you're having issues with overlapping labels on a chart.

[gganimate](#) - If you ever feel like getting more elaborate with your graphics, this gives you a simple way to create animated ones within R and ggplot.



Hope You Enjoy the Data!

Any questions:

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