Introduction

In this blog post I'll be talking about my submission to the 2020 RStudio Table contest: A xG and shots timeline table for soccer/football matches powered by data from understat.com!

I started out in soccer analytics mainly to practice my data cleaning and visualization skills and over time it evolved into an entire portfolio of plots and graphs that you can see in the soccer_ggplots Github Repo. At the beginning of last season (summer of 2019) I figured out how to grab match-level data from understat.com via Ewen Henderson's {understatr} package and started creating a "match day summary graphic". These were intended to visualize the data understat.com provided in my own aesthetically-pleasing way for the **general public** (mainly on soccer analytics Twitter). These aren't intended for **coaches/clubs** but are more **media/fan oriented** pieces to help convey the flow of the match in a different way than the usual box scores (number of shots, tackles, yellow cards, total passes, etc.).

Version 1 (last year) looked like this:

In the past few months, after the Corona-extended-season ended, I intended to make tweaks to the graph above but instead I just started creating other viz with the data available while also incorporating some other stuff that I couldn’t fit into the original match day viz.

One of the new viz I created was a chronological table of shots during the course of the match which provides the viewer with a lot more detail about any individual shot. Besides the xG value, things like the “situation” (open play? free kick? etc.), “shot type” (right, left, header), etc. were added for more context. In general I wanted the next series of viz to add a bit more context to the overall xG flow graph and the shot maps.

So here are the new xG match summary viz in their entirety (minus the timeline table which was the first image you saw on this blog post):

Set Piece

Penalty

Open Play

From Corner

0%

From Free Kick

Open Play

(

This blog post will **only** go over the {gt} time lines.

Design Choices

I mostly make very simple designs in my soccer visualizations and I try not to clutter each individual viz with too much info, but rather try to peel layers of data apart and split them up into different component viz (for more examples see here.
In reality, this table viz is only just one of a series of data viz intended to capture details about a match using understat.com's data that I post on Twitter
but since this tutorial is for a table viz competition, I'll keep the following discussion to the table viz only.

The **color-coding** of the rows is intended to give you a clear idea of who was dominating shots at any given time period at a glance, without even having to look closely at the details. Of course, there may be a ton of shots in a small period of time or vice-versa which can skew your perception if you don't look at the "minute" column closely. Still, I think it's cool that you can look at the table from far away and identify time "chunks" of shot dominance. The previous few sentences only touch on the info about the "quantity" of shots taken. The "quality" of the shots can be gleaned from looking at the shot maps, as well as the cumulative sum of a team's xG as you travel down the table chronologically.

Most of the **plots** you see inserted into {gt} or other R tables in general are spark lines so I thought about including them in mine too. However, I realized that the cumulative xG column covers that and the line graph wasn't very visible on the table. The chronological nature of the table also means you get a feel for that perspective of the game anyways (e.g. chunks of "red" rows means that team "red" was taking more shots in that time period). In any case the line plot is already covered by another viz in my series so I decided to focus on something that's a lot easier to see at first glance, the main protagonist of the table, the actual shots themselves. The idea was to plot all of the shots of that table row's respective team on a soccer field plot and then highlight the specific shot of that row along with its xG value.

For the **title headline text** I experimented with a few different sizes depending on the text content (team name, xG value, score line). The actual score being the biggest in size, then the team names, and then the xG totals for either team in the smallest font at the far ends. I'm still not sure how the text alignment (especially vertical) works so I didn't want to try anything too drastic. I'm still not very fond of the fact that the parentheses around the xG values kind of dip below the other letters, especially the larger text. I am also still vacillating between adding a bit more color to either "xG" or the xG values themselves along their respective team colors. I did all of this as I wanted people to guide people's focus on **actual** score line first and then down across to the **xG** values. I have Expected Points (xPoints) in the other match graphics so for the stand-alone version of the tables it would make sense to include them somehow in a later version as well.

I made the **column header** color slightly gray to differentiate the text from the title text but I'm still not 100% sure it provides a good balance with the rest of the text in the table. For the text inside the **table cells** I made sure they were thick bold text as it in the version that I used to release with my other match viz they were a lot thinner and harder to read. I tried to place emphasis on rows with goals by switching the text to all-caps and adding the emoji alongside it. I think there could be ways of adding more emphasis by coloring the border of that row or something else. Unfortunately, for the PNG version in my regular match summary viz that I post on Twitter, the emoji is a star instead of a soccer ball as the soccer ball emoji doesn't convert well from HTML to PNG. I'll be using the soccer ball emoji here as I'm aiming for an HTML output and don't really care about its ability to be embedded in tweets.

Some other concerns I have are as follows. The large size of table is a concern as it is not very mobile-friendly nor small-screen friendly, even on computers. The size could still be tweaked but I'm not really sure about making it any smaller or the shot map will be even less visible than it already is. My own inexperience with HTML/CSS to get team logos to slot in on either side of the title text. This was only solved after hours upon hours of failed attempts and honestly took up most of my time creating this viz.

There is a need to be careful about what colors to use as the main team colors (yellow for example is strictly off-limits). A dark theme design could potentially be used to alleviate some of the concerns with using yellow or other brighter colors that don't work well with white bold text. Another idea is to use an if-else statement to switch the text to black if the color fill for that row is a certain set of bright colors too.

The team logos are all taken from Wikipedia so the sizes may differ slightly. I may try specifying a specific aspect ratio in the HTML/CSS code but the logos can come in different shapes as well. I also wanted to place the logos slightly inward closer to the text and not exactly in the corners as they are now but setting margins around the logo images caused other problems.

As this is a **static visualization** there aren't any scrolling elements embedded in the table itself nor are there freeze panels so that the column labels follow you as you go down the table. I did try to alleviate this problem by ordering the columns in a way so that its immediately obvious what the column is showing. An interactive version is the solution for a lot of these problems and it may be worth looking into in the future.

Packages

THe packages we'll be using are some of the usual tidyverse stalwarts such as {dplyr}, {tidyr}, {ggplot2}, {forcats}, etc. For soccer-specific packages we have the {understatr} package for downloading the data and the {ggsoccer} package for creating soccer fields in {ggplot2}.

We also use the {extrafont} package to make use of some cool fonts for the table/plots, they're loaded in via the `loadfonts()` call. I'll be using the "Roboto Condensed" and "Roboto Slab" fonts that you can download from Google Fonts. Please read the instructions on extrafont's Github repo and/or CRAN docs for how to install fonts on your computer and use them in R. If you don't want to bother with all that then just delete the code where I specify fonts throughout the blog post.

Also attached is my `sessionInfo()`.

```
# Packages
pacman::p_load(dplyr, tidyr, stringr, janitor, purrr,
               tibble, lubridate, glue, rlang,
               rvest, polite,
               ggplot2,
               gt, forcats, ggtext, extrafont,
               understatr, ggsoccer)
## Load fonts
loadfonts(quiet = TRUE)

sessionInfo()
```

```
## R version 3.5.3 (2019-03-11)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 19041)
##
## Matrix products: default
##
## locale:
## [1] LC_COLLATE=English_United States.1252
## [2] LC_CTYPE=English_United States.1252
## [3] LC_MONETARY=English_United States.1252
## [4] LC_NUMERIC=C
## [5] LC_TIME=English_United States.1252
##
```

```
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] ggsoccer_0.1.4       understatr_1.0.0.9000 extrafont_0.17
##  [4] ggtext_0.1.0         forcats_0.5.0         gt_0.2.2
##  [7] ggplot2_3.3.0        polite_0.1.1          rvest_0.3.5
## [10] xml2_1.3.2           rlang_0.4.7           glue_1.4.1
## [13] lubridate_1.7.4      tibble_3.0.1          purrr_0.3.4
## [16] janitor_1.2.1        stringr_1.4.0         tidyr_1.1.0
## [19] dplyr_1.0.1          goodshirt_0.2.2
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_1.0.4.6      pillar_1.4.4.9000 compiler_3.5.3    tools_3.5.3
##  [5] digest_0.6.25     robotstxt_0.6.2   jsonlite_1.7.0    gtable_0.3.0
##  [9] evaluate_0.14     memoise_1.1.0     lifecycle_0.2.0   pkgconfig_2.0.3
## [13] yaml_2.2.1        xfun_0.12.2       Rttf2pt1_1.3.8    withr_2.2.0
## [17] httr_1.4.1        knitr_1.27        fs_1.4.1          generics_0.0.2
## [21] vctrs_0.3.2       gridtext_0.1.0    grid_3.5.3        rprojroot_1.3-2
## [25] tidyselect_1.1.0  here_0.1          R6_2.4.1          qdapRegex_0.7.2
## [29] rmarkdown_2.1     pacman_0.5.1      extrafontdb_1.0   ratelimitr_0.4.
## [33] magrittr_1.5      scales_1.1.0      usethis_1.6.1     backports_1.1.8
## [37] ellipsis_0.3.1    htmltools_0.5.0   assertthat_0.2.1  colorspace_1.4-
## [41] stringi_1.4.6     munsell_0.5.0     crayon_1.3.4
```

Data Source

understat.com is a data source used by fans,
media, bloggers, and analysts alike as it is a free and open resource
for expected goals data across six European soccer leagues, the English
Premier League, La Liga (Spain), Bundesliga (Germany), Serie A (Italy),
Ligue 1 (France), and RFPL (Russia). The data goes back to the 2014-2015
season and has a lot of different xG and xG-adjacent data to look at on
tables, graphs, and pitch maps.

Definitions for the variables are provided by hovering over column names
on the website. Others are opaque but follow similar terminology set by
other data companies and websites. For the average Joe
understat.com along with the more recent
FBref (with advanced metrics provided by StatsBomb) are
the best free and publicly available websites for obtaining this kind of
data that I know of.

Nothing is really stopping you from using StatsBomb, Opta, InStat,
WyScout, etc. data to create these tables, you just need a few extra
steps to prepare/structure the data sets similarly to how I've done it
the next few sections.

According to the website, the xG model that understat use to calculate
the values are done via a neural network on a data set of over 100,000
shots with over 10 parameters. The biggest concern with using the data
is that I'm not in control over the calculated outputs and I am merely
going to be using their data as given. It would be a point of interest

to create my own xG model based on the variables provided on understat (as well as combining data from other sources) by following some of the "how-to" blog posts around the #rstats world such as:

- Fitting your own football xG model – Dato Futbol by Ismael Gomez
- xG Model – Design and Implementation with R Tidymodels by Lars M.

Code Breakdown (Part 1): Initial Data Gathering &

We can finally get to the real meat of this blog post which is the code to create the visualization. We'll be going through things almost line-by-line and then at the end we'll create a function out of the code so it can be applied to other matches/teams as well!

Let's get started!

Defining Variables

The variables defined below will be used throughout the code and some are appended to the data frames we'll be creating and cleaning. They'll also be used as arguments for a function we'll create that takes in all the code that's be described throughout this blog post.

Make sure that the "home_team" and "away_team" variables are the exact names for the teams on understat.com but without the _ symbols (e.g. "West_Ham" should be "West Ham", "Borussia_M.Gladbach" should be "Borussia M.Gladbach"). The underscores will be converted throughout the code so don't worry about them. You have to be careful as some teams on understat.com are labeled with their full name ("West_Bromwich_Albion", "Parma_Calcio_1913") while some other ones aren't ("Tottenham", "Brighton", "Leeds").

The team color is your choice but the table will be using **white** text so be sure to not choose yellow or white. For teams like Borussia Dortmund I usually just choose **black**. There are a number of great web sites for finding team colors such as:

- Encycolorpedia
- Team Color Codes
- Team Colours App – FC Python

Finally you can set the match date, league, season, match day, and source text to show in the table in whatever format you wish. You can actually scrape the "match_date" via {understatr} as well but I didn't want to bother reformatting with {lubridate} so I just set it manually here.

```
home_team = "Liverpool"
```

```
away_team = "Leeds"
home_color = "#d00027"
away_color = "#1D428A"

home_team_logo <- "https://i.imgur.com/RlXYW46.png"
away_team_logo <- "https://i.imgur.com/r6Y9lT8.png"

match_date <- "Sep. 12, 2020"
league_year <- "Premier League 2020-2021"
matchday <- 1
source_text <- "**Table**: Ryo Nakagawara (**Twitter**: @R_by_Ryo) | **Data**
```

{understatr} Package

You can get the data via the {understatr} package from Ewen Henderson. There are a number of blog posts that you may want to look into alongside the official documentation:

- Shot Data for Top 5 European Leagues by Mark Wilkins
- Visualizing the Copa America 2019

To get match shot data for a match you need to find the match ID on understat. There are a number of helper functions to help you find this ID but you can just go to understat and find it yourself as the ID is part of the URL for the match page. Another way is to scrape the team's page on understat and then you'll have the match IDs for that team (including for matches they haven't played yet). https://understat.com/match/14090 is the URL for Liverpool vs. Leeds United and the set of digits at the end, `14090`, is the match ID. You use this ID as the input to the `get_match_shots()` function to get the raw match shots data.

```
match_id <- 14090
raw_match_df <- understatr::get_match_shots(match_id = match_id)

glimpse(raw_match_df)
```

```
## Rows: 28
## Columns: 20
## $ id             376602, 376603, 376604, 376606, 376607, 376608, 376...
## $ minute         2, 3, 6, 19, 24, 28, 32, 39, 39, 48, 52, 52, 59, 61...
## $ result         "BlockedShot", "Goal", "BlockedShot", "Goal", "Save...
## $ X              0.875, 0.885, 0.860, 0.946, 0.734, 0.936, 0.870, 0....
## $ Y              0.347, 0.500, 0.322, 0.542, 0.374, 0.359, 0.392, 0....
## $ xG             0.06855621, 0.76116884, 0.06080124, 0.41931298, 0.0...
## $ player         "Mohamed Salah", "Mohamed Salah", "Mohamed Salah", ...
## $ h_a            "h", "h", "h", "h", "h", "h", "h", "h", "h", "h", "...
## $ player_id      1250, 1250, 1250, 833, 605, 5247, 1250, 838, 838, 7...
## $ situation      "OpenPlay", "Penalty", "OpenPlay", "FromCorner", "O...
## $ season          2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType        "LeftFoot", "LeftFoot", "LeftFoot", "Head", "RightF...
## $ match_id        14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team          "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team          "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ h_goals         4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, ...
## $ a_goals         3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, ...
## $ date            "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted "Sadio Mané", NA, "Sadio Mané", "Andrew Robertson",...
## $ lastAction      "Pass", "Standard", "Pass", "Cross", "None", "None"...
```

When I was first making these plots (around a year ago) the `understatr::get_match_shots()` function didn't exist so I had my own way of scraping this data. I've kept using my own methods in my personal scripts but for the purposes of this blog post I'll use `understatr::get_match_shots()` for your convenience.

The raw data we get is already in good shape thanks to {understatr} but we still need to do some more cleaning and setting some variables the way we want for our table.

```
shots_df <- raw_match_df %>%
  ## 1. Take out 2 columns we don't really need.
  select(-h_goals, -a_goals) %>%
  ## 2. Make sure the selected columns are set to numeric type.
  mutate(across(c(minute, xG, X, Y,
                   player_id, match_id, season), as.numeric)) %>%
  ## 3. If xG is `NA` then set it to 0.
  ## 4. Relabel the categories in "result", "situation", "lastAction", and "s
so they're more human-friendly and presentable.
  mutate(xG = if_else(is.na(xG), 0, xG),
         result = case_when(
           result == "SavedShot" ~ "Saved Shot",
           result == "BlockedShot" ~ "Blocked Shot",
           result == "MissedShots" ~ "Missed Shot",
           result == "ShotOnPost" ~ "On Post",
           result == "OwnGoal" ~ "Own Goal",
           TRUE ~ result),
         situation = case_when(
           situation == "OpenPlay" ~ "Open Play",
           situation == "FromCorner" ~ "From Corner",
           situation == "DirectFreekick" ~ "From Free Kick",
           situation == "SetPiece" ~ "Set Piece",
           TRUE ~ situation),
         lastAction = case_when(
           lastAction == "BallRecovery" ~ "Ball Recovery",
           lastAction == "BallTouch" ~ "Ball Touch",
           lastAction == "LayOff" ~ "Lay Off",
           lastAction == "TakeOn" ~ "Take On",
           lastAction == "Standard" ~ NA_character_,
           lastAction == "HeadPass" ~ "Headed Pass",
           lastAction == "BlockedPass" ~ "Blocked Pass",
           lastAction == "OffsidePass" ~ "Offside Pass",
           lastAction == "CornerAwarded" ~ "Corner Awarded",
           lastAction == "Throughball" ~ "Through ball",
           lastAction == "SubstitutionOn" ~ "Subbed On",
           TRUE ~ lastAction),
         shotType = case_when(
           shotType == "LeftFoot" ~ "Left Foot",
           shotType == "RightFoot" ~ "Right Foot",
           shotType == "OtherBodyPart" ~ "Other",
           TRUE ~ shotType)) %>%
  ## 5. Consolidate team name into a single column "team_name" based on the "
  mutate(team_name = case_when(
    h_a == "h" ~ h_team,
    h_a == "a" ~ a_team)) %>%
  ## 6. Add team colors to the row depending on the team.
  mutate(team_color = if_else(team_name == h_team, home_color, away_color)) %
  ## 7. Own Goal is set to the team that conceded it so swap it to the team t
scored from it.
  mutate(team_name = case_when(
    result == "Own Goal" & team_name == home_team ~ away_team,
    result == "Own Goal" & team_name == away_team ~ home_team,
    TRUE ~ team_name)) %>%
  ## 8. Set "team_name" as a factor variable.
  mutate(team_name = forcats::as_factor(team_name)) %>%
  ## 9. Arrange the rows by `id` so that shots are in chronological order.
  arrange(id) %>%
  ## 10. Separate "player" into two, then re-combine.
  separate(player, into = c("firstname", "player"),
           sep = "\\s", extra = "merge") %>%
  ## players like Fabinho are listed without a last name "Tavares"
  ## so just add their name in again if NA
  mutate(player = if_else(is.na(player), firstname, player),
         ## 11. Set a new and cleaner ID for shots so that it starts at 1 and
         id = row_number())

glimpse(shots_df)

## Rows: 28
## Columns: 21
## $ id             1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ...
## $ minute         2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ result         "Blocked Shot", "Goal", "Blocked Shot", "Goal", "Go...
## $ X              0.875, 0.885, 0.860, 0.842, 0.946, 0.734, 0.936, 0....
## $ Y              0.347, 0.500, 0.322, 0.607, 0.542, 0.374, 0.359, 0....
## $ xG             0.06855621, 0.76116884, 0.06080124, 0.05824600, 0.4...
## $ firstname      "Mohamed", "Mohamed", "Mohamed", "Jack", "Virgil", ...
## $ player         "Salah", "Salah", "Salah", "Harrison", "van Dijk", ...
## $ h_a            "h", "h", "h", "a", "h", "h", "h", "a", "h", "h", "...
## $ player_id      1250, 1250, 1250, 8720, 833, 605, 5247, 822, 1250, ...
## $ situation      "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ season         2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType       "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ match_id         14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team           "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team           "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ date             "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted  "Sadio Mané", NA, "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction       "Pass", NA, "Pass", "Take On", "Cross", "None", "No...
## $ team_name        Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ team_color       "#d00027", "#d00027", "#d00027", "#1D428A", "#d0002...
```

You have to adjust xG for a single sequence of possession so I regularly use the code in Joe Gallagher's blog post for adjusting them whenever there's a sequence with a rebound.

The xG totals (Liverpool `3.15 xG` vs. Leeds United `0.27 xG`) you see on understats' match pages are using the **ADJUSTED** values **BUT** the xG values you see on their shot maps (when you hover over them with your mouse) are the **RAW** values which are same as the ones downloaded via {understatr}. So do be careful when you're taking shot data from the website. 99% of the time this discrepancy has been solved by applying the below code from Joe's blog post to rebound shots and other shots in that possession sequence. Understat could be doing something else under the hood but from my experience this usually matches the values up. Do note that not all shots that were adjusted by understat for the box score have the "rebound" shot result label which makes it much more difficult to tease out which ones need the adjustment. This is why its important you watch the match or have an easy way of checking every shot/shot sequence.

```
shots_df %>% filter(team_name == "Liverpool") -> lfc_xg

lfc_adj <- lfc_xg %>%
  filter(minute == 39) %>%
  mutate(xg_total = (1 - prod(1 - xG))) %>%
  mutate(xg_adj = xg_total * (xG / sum(xG))) %>%
  select(minute, xG, xg_adj, player, situation, lastAction)

glimpse(lfc_adj)
```

```
## Rows: 2
## Columns: 6
## $ minute      39, 39
## $ xG          0.10687961, 0.08808844
## $ xg_adj      0.10171848, 0.08383471
## $ player      "Mané", "Mané"
## $ situation   "Open Play", "Open Play"
## $ lastAction  "Pass", "Rebound"
```

Then we just overwrite the raw xG values with the adjusted values into `shots_df`.

```
shots_df <- shots_df %>%
  mutate(xG = case_when(
    minute == 39 & id == 10 ~ 0.10171848,
    minute == 39 & id == 11 ~ 0.08383471,
    TRUE ~ xG))
```

Rolling sum of xG

This data frame calculates the rolling sum of xG values throughout the match. Use the `cumsum()` function to calculate it along the order of shots. This bit of code is actually used for creating the line plot timeline viz you saw in the introduction but for the table viz we only need the shot ID and the rolling sum values so that's what we'll `select()` from the data frame.

```
## 1. Get minute of last shot
last_min <- shots_df$minute %>% unique() %>% last()

## 2. If last shot happened before 90th minute then change to 90
if (last_min < 90) {last_min <- 90}

## 3. Create index of every minute in the match
minute <- c(0:last_min)

## 4. Set team names in a list
team_name <- c(shots_df$h_team %>% unique(),
               shots_df$a_team %>% unique())

rollsum_df <- shots_df %>%
  ## 5. Expand shots_df to include rows for every minute
  full_join(crossing(minute, team_name)) %>%
  arrange(minute) %>%
  group_by(team_name) %>%
  ## 6. Change NAs to 0
  ## Apply rolling cumulative sum on xG
  mutate(xG = if_else(is.na(xG), 0, xG),
         rollsum = lag(cumsum(xG))) %>%
  ungroup() %>%
  ## 7. Change Player Labels (Not used for the table viz so can be ignored)
  mutate(rollsum_goal = rollsum + xG) %>%
  ## for Minute == 0
  mutate(rollsum = if_else(is.na(rollsum), 0, rollsum),
         rollsum_goal = if_else(is.na(rollsum_goal), 0, rollsum_goal)) %>%
  ## FOR THIS BLOGPOST // {gt} TABLE WE DON'T NEED MOST OF THESE COLUMNS
  ## We'll only use the shot order ID and the rolling sum of xG that we just
  filter(xG != 0.00) %>%
  select(id, rollsum_goal)

## Joining, by = c("minute", "team_name")

glimpse(rollsum_df)

## Rows: 28
## Columns: 2
## $ id           1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16,...
## $ rollsum_goal 0.06855621, 0.82972505, 0.89052629, 0.05824600, 1.3098...
```

Team Stats (Box score data frame)

This is the data you can see on the "Stats" tab on any match page on understat.com. In my own work flow this code is its own function along with a few additions which aren't pertinent to creating the tables. We'll be scraping this directly using the {polite} and {rvest} packages. Then we'll slowly massage the text data into a nice data frame.

```
match_url <- stringr::str_glue("https://understat.com/match/{match_id}")

match_page <- polite::bow(match_url)

team_stats_raw <- polite::scrape(match_page) %>%
  html_nodes("div.scheme-block:nth-child(4)") %>%
  html_text() %>%
  str_remove_all(., "CHANCES") %>%
  str_remove_all(., "([0-9]{2,}%)") %>%
  str_replace_all(., "SHOTS ON TARGET", "ON-TARGET") %>%
  str_squish()

## make sure that you set "home_team" and "away_team" in the beginning, exact
on understat.com
if (str_detect(home_team, " ") == TRUE |
    str_detect(away_team, " ") == TRUE) {

  home_team_sp <- str_replace_all(home_team, " ", "-")
  away_team_sp <- str_replace_all(away_team, " ", "-")

  team_stats_raw <- team_stats_raw %>%
    str_replace_all(., home_team, home_team_sp) %>%
    str_replace_all(., away_team, away_team_sp)
}

home_team_sp <- str_replace_all(home_team, " ", "-")
away_team_sp <- str_replace_all(away_team, " ", "-")

team_stats <- team_stats_raw %>%
  read.table(text = ., header = FALSE, sep = " ",
             col.names = c("var_name", "home", "away")) %>%
  t() %>%
  tibble::as_tibble(.name_repair = "minimal") %>%
  janitor::row_to_names(row_number = 1) %>%
  mutate_at(vars(-TEAMS), ~ as.numeric(.)) %>%
  mutate(TEAMS = case_when(
    str_detect(TEAMS, home_team_sp) ~ home_team,
    str_detect(TEAMS, away_team_sp) ~ away_team,
    TRUE ~ TEAMS
  ))
```

```
## split team stats into "home" and "away"
home_stats <- team_stats[1,]

away_stats <- team_stats[2,]

## add colors based on defined variables for team's respective color
home_stats$home_team_color <- home_color
away_stats$away_team_color <- away_color

glimpse(team_stats)

## Rows: 2
## Columns: 8
## $ TEAMS        "Liverpool", "Leeds"
## $ GOALS        4, 3
## $ xG           3.15, 0.27
## $ SHOTS        22, 6
## $ `ON-TARGET`  6, 3
## $ DEEP         19, 2
## $ PPDA         9.94, 9.33
## $ xPTS         2.93, 0.04
```

You can check out more on how to scrape websites responsibly with the {rvest} and {polite} packages in my previous blog post here.

Data contents

Now that we've got the basic data we need, let's go over what each data frame holds. We'll still be doing a lot more data manipulation after this section but it's a good place to pause as we have the essential columns we need. These are also the data frames we'll pass as arguments into the function we'll create for the table. In my usual workflow the above Part 1 are usually a few different functions and then the code in Part 2 and Part 3 are in a different single function that creates the {gt} tables. You can certainly shove Part 1 code into the overall function as well but I use the data frames from Part 1 in other visualizations so I have them split up.

1. shots_df

This data frame is the main protagonist for our table and holds pretty much all the essential info we need. You can add/subtract any columns as you see fit from understat or from your own data source here.

```
glimpse(shots_df)

## Rows: 28
## Columns: 21
## $ id              1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ...
## $ minute          2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ result          "Blocked Shot", "Goal", "Blocked Shot", "Goal", "Go...
## $ X                0.875, 0.885, 0.860, 0.842, 0.946, 0.734, 0.936, 0....
## $ Y                0.347, 0.500, 0.322, 0.607, 0.542, 0.374, 0.359, 0....
## $ xG               0.06855621, 0.76116884, 0.06080124, 0.05824600, 0.4...
## $ firstname        "Mohamed", "Mohamed", "Mohamed", "Jack", "Virgil", ...
## $ player           "Salah", "Salah", "Salah", "Harrison", "van Dijk", ...
## $ h_a              "h", "h", "h", "a", "h", "h", "h", "a", "h", "h", "...
## $ player_id        1250, 1250, 1250, 8720, 833, 605, 5247, 822, 1250, ...
## $ situation        "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ season           2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType         "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ match_id         14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team           "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team           "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ date             "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted  "Sadio Mané", NA, "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction       "Pass", NA, "Pass", "Take On", "Cross", "None", "No...
## $ team_name        Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ team_color       "#d00027", "#d00027", "#d00027", "#1D428A", "#d0002...
```

- **minute**: Minute of the game that the shot was taken. Note that this doesn’t contain seconds so you need to be careful when re-arranging rows. When you get the data via {understatr} the data should come in proper order so the first thing you should do is to create an ID variable so that you always have shots in the same minute in the proper order.

- **result**: The result of the shot. “Goal”, “Blocked Shot”, “Saved Shot”, “Own Goal”, etc.

- **X & Y**: Coordinates of the shot location.

- **xG**: Expected Goals value of the shot taken per understat.com’s model.

- **firstname** & **player**: Player name. firstname is a column I created myself for the shot timeline/shot maps in a previous step of my viz process. When you’re grabbing the data from understat yourself it should already be in one united column. We’ll go over the code to combine these together for the table.

- **h_a**: Home or away team. These are used for matching the team colors to their respective row and is in general useful when you have turned your code into a function and want to set certain conditions depending on whether the team is “home” or “away”.

- **player_id** & **match_id**: understat IDs for players and matches. Not used here but good to keep if you’re going to be doing other stuff later on.

- **situation**: The situation in which the shot took place. “Open Play”, “Set Piece”, “Penalty”, etc.

- **season**: Season. Not used here but good to keep if you’re doing other stuff with this data.

- **shotType**: Type of shot. “Left Foot”, “Right Foot”, & “Header”.
- **date**: Date of match. We could use {lubridate} or something to make it look nice but for this example I just manually created a variable “match_date”.
- **player_assisted**: Player that assisted the shot. Do note that “assisted” could mean very trivial things like a small touch or a deflection.
- **lastAction**: Action that lead to the shot. “Pass”, “Dribble”, “Take On”, “Cross”, “Rebound”, etc. There are some mystery labels such as “Standard” but we’ll be removing them from the data in the code section.
- **team_name**: Team name used for labels.

1. rollsum_df

Has the rolling sum of xG values for the match over every shot taken in the match.

```
glimpse(rollsum_df)
```

```
## Rows: 28
## Columns: 2
## $ id           1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16,...
## $ rollsum_goal 0.06855621, 0.82972505, 0.89052629, 0.05824600, 1.3098...
```

1. home_stats & away_stats

The box score you see in the “Stats” tab of the match page on understat.com. “home_stats” and “away_stats” is just “team_stats” divided into their respective teams. The data below are ONLY used for labels and titles in the plot so if you’re not too fussed about scraping the data in the previoius you could just manually insert them in the text (we’ll be using `paste()`/`glue()` to insert this into the plot text) or add the info as arguments to your plotting function and insert this data that way as well.

```
glimpse(team_stats)
```

```
## Rows: 2
## Columns: 8
## $ TEAMS        "Liverpool", "Leeds"
## $ GOALS        4, 3
## $ xG           3.15, 0.27
## $ SHOTS        22, 6
## $ `ON-TARGET`  6, 3
## $ DEEP         19, 2
## $ PPDA         9.94, 9.33
## $ xPTS         2.93, 0.04
```

Code Breakdown (Part 2): Creating the Shot Map

Creating the soccer field plots

For the actual soccer field I use the {ggsoccer} package. Along with the pitch dimension specifications for data sources like Opta, WyScout, and StatsBomb, the package also allows you to specify your own dimensions to fit your own data. If you want a bit more of an in-depth code through using the {ggsoccer} package, take a look at the package README or have a look at one of my first blog posts where I create my own World Cup 2018 data and visualize it with {ggsoccer}.

After playing around with the dimensions on understat the below are the measurements what I came up with and I defined it as a variable called `pitch_custom`.

```
pitch_custom <- list(
  length = 587,
  width = 373,
  penalty_box_length = 101,
  penalty_box_width = 211,
  six_yard_box_length = 31,
  six_yard_box_width = 111,
  penalty_spot_distance = 66,
  goal_width = 45,
  origin_x = 0,
  origin_y = 0)
```

Since we are orienting the shot maps vertically we need to convert the coordinates from the horizontal view to vertical. We are only using one side of the pitch we don't need to have different adjustments for the "home" and "away" teams. The new coordinates will be defined to the variables "X" and "Y" (capitalized), the coordinates in the lower-case variables will be kept in just as a reference and for checking positions. Then we `select()` only the variables we need then capitalize "Goal" and "Own Goal" labels for the table (you could also use `stringr::str_to_upper()` here). Also note that you can include most if not **all** of these `mutate()` calls into **one** `mutate()` call but I like to keep them separated so I can comment out blocks of code easier.

```
## create coords
match_df <- shots_df %>%
  ## switch coordinates for vertical view
  mutate(
    x = case_when(
      h_a == "a" ~ X * 587,
      h_a == "h" ~ X * 587,
      TRUE ~ 0),
    y = case_when(
      h_a == "a" ~ Y * 373,
      h_a == "h" ~ Y * 373,
      TRUE ~ 0)) %>%
  ## edit result values
  mutate(result = case_when(
    result == "Goal" ~ "GOAL",
    result == "Own Goal" ~ "OWN GOAL",
    TRUE ~ result)) %>%
  mutate(result = forcats::as_factor(result),
         result = forcats::fct_relevel(result, "GOAL", "Saved Shot",
                                       "On Post", "Blocked Shot",
                                       "Missed Shots", "OWN GOAL"))
```

```
## Warning: Problem with `mutate()` input `result`.
## x Unknown levels in `f`: On Post, Missed Shots, OWN GOAL
## i Input `result` is `forcats::fct_relevel(...)`.

## Warning: Unknown levels in `f`: On Post, Missed Shots, OWN GOAL
```

This is how the data looks like now. There’s a row for every shot in chronological order along with the coordinates for the shots.

```
glimpse(match_df)
```

```
## Rows: 28
## Columns: 23
## $ id                1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ...
## $ minute            2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ result            Blocked Shot, GOAL, Blocked Shot, GOAL, GOAL, Saved...
## $ X                 0.875, 0.885, 0.860, 0.842, 0.946, 0.734, 0.936, 0....
## $ Y                 0.347, 0.500, 0.322, 0.607, 0.542, 0.374, 0.359, 0....
## $ xG                0.06855621, 0.76116884, 0.06080124, 0.05824600, 0.4...
## $ firstname         "Mohamed", "Mohamed", "Mohamed", "Jack", "Virgil", ...
## $ player            "Salah", "Salah", "Salah", "Harrison", "van Dijk", ...
## $ h_a               "h", "h", "h", "a", "h", "h", "h", "a", "h", "h", "...
## $ player_id         1250, 1250, 1250, 8720, 833, 605, 5247, 822, 1250, ...
## $ situation         "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ season            2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType          "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ match_id          14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team            "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team            "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ date              "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted   "Sadio Mané", NA, "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction        "Pass", NA, "Pass", "Take On", "Cross", "None", "No...
## $ team_name         Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ team_color        "#d00027", "#d00027", "#d00027", "#1D428A", "#d0002...
## $ x                 513.625, 519.495, 504.820, 494.254, 555.302, 430.85...
## $ y                 129.431, 186.500, 120.106, 226.411, 202.166, 139.50...
```

Using this data frame we can create shot map plots that will serve as the base for a more detailed plot in a later section.

Function to define base shot map

This function will take the `data` and `team_name` inputs that come from the `match_df` data frame that we just created. This plot will plot

all shots per team for every row of the data frame. After using `filter()` to only get the shots for the specific team, `annotate_pitch()` is used to create the pitch object using the dimensions we specified in `pitch_custom` earlier. The `theme_pitch()` is a helper function for {ggsoccer} that removes all the background and axes details while `coord_flip()` is used to flip the field so that the goal is at the top of the plot. All the shots will be gray and transparent (via the 'alpha' argument) as later on we will highlight the actual shot for a specific row in our table in a different plotting function.

```
create_shotmap_basic <- function(df = data, team_name = team_name) {

  shotxG_map_raw <-
    ggplot(df %>% filter(team_name == team_name),
           aes(x = x, y = y)) +
    annotate_pitch(dimensions = pitch_custom) +
    ## all shots in grey and transparent
    geom_point(aes(x = x, y = y), color = "grey20",
               size = 3, alpha = 0.3) +
    #scale_x_continuous(expand = c(0.01, 0)) +
    theme_pitch(aspect_ratio = 373/587) +
    coord_flip(xlim = c(280, 590),
               ylim = c(10, 365)) +
    theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "pt"),
          text = element_markdown(family = "Roboto Condensed"),
          legend.position = "none")

  return(shotxG_map_raw)
}
```

We `nest()` the data by "team_name" so that when we plot our basic shot maps each row will plot all the shots for each team in "team_name". By "nesting" the data this way we can apply the plotting function to **all** the data for a specific team team. This way we won't be plotting a basic shot map using shot data from both teams.

```
match_df %>% tibble::as_tibble() %>% group_by(team_name) %>% nest()

## # A tibble: 2 x 2
## # Groups:   team_name [2]
##   team_name data
##
## 1 Liverpool
## 2 Leeds
```

The "data" column contains **all** the data that we saw previously for each team. If we `unnest()` the "data" column for the row with "Liverpool" in the "team_name" column we can see that it contains all the data seen previously but **only** for Liverpool. The same will apply if we "unpack" the "data" column for the row with Leeds United.

```
match_df %>%
  tibble::as_tibble() %>%
  group_by(team_name) %>%
  nest() %>%
  head(1) %>%
  unnest(cols = c(data))
```

```
## # A tibble: 22 x 23
## # Groups:   team_name [1]
##    team_name    id minute result     X     Y     xG firstname player h_a
##
##  1 Liverpool     1      2 Block~ 0.875 0.347 0.0686 Mohamed   Salah  h
##  2 Liverpool     2      3 GOAL   0.885 0.5   0.761  Mohamed   Salah  h
##  3 Liverpool     3      6 Block~ 0.86  0.322 0.0608 Mohamed   Salah  h
##  4 Liverpool     5     19 GOAL   0.946 0.542 0.419  Virgil    van D~ h
##  5 Liverpool     6     24 Saved~ 0.734 0.374 0.0191 Jordan    Hende~ h
##  6 Liverpool     7     28 Block~ 0.936 0.359 0.0941 Naby      Keita  h
##  7 Liverpool     9     32 GOAL   0.87  0.392 0.0624 Mohamed   Salah  h
##  8 Liverpool    10     39 Block~ 0.849 0.557 0.102  Sadio     Mané   h
##  9 Liverpool    11     39 Block~ 0.862 0.56  0.0838 Sadio     Mané   h
## 10 Liverpool    12     48 Saved~ 0.891 0.543 0.121  Georginio Wijna~ h
## # ... with 12 more rows, and 13 more variables: player_id ,
## #   situation , season , shotType , match_id ,
## #   h_team , a_team , date , player_assisted ,
## #   lastAction , team_color , x , y
```

With this data structure in hand, we apply the basic shot map plot function to every row of data inside the “data” column for both teams. We can do this by passing the “data” and “team_name” columns as the arguments to the shot map function which then iterates over every row in each team’s “data” column.

```
## add blank shot map to all rows
match_df_basic_plot <- match_df %>%
  tibble::as_tibble() %>%
  ## nest by team
  group_by(team_name) %>%
  nest() %>%
  ## apply plots for all shots per team, for each row in their respective "da
  mutate(plot = map2(data, team_name, create_shotmap_basic)) %>%
  ungroup()
```

When we take a `glimpse()` at our data frame we now see an additional column, “plot” that houses plots for each row of shots for both teams. So Liverpool took 22 total shots and therefore have 22 rows inside “data” which results in 22 plots while for Leeds there are 6, 6, and 6 of the same. Both “data” and “plot” are now what are called “list-columns”.

```
glimpse(match_df_basic_plot)
```

```
## Rows: 2
## Columns: 3
## $ team_name  Liverpool, Leeds
## $ data       [, ]
## $ plot       [<1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17, 19, 2...
```

So now we have a data frame with a basic shot map for each team for each row of shots. However, all of the detailed info we need for our table is hidden inside the “data” column. We can get those back by `unnest()`-ing the “data” column so all the other shot information is unpacked.

```
match_df_basic_plot <- match_df_basic_plot %>%
  unnest(cols = "data") %>%
  arrange(id)

glimpse(match_df_basic_plot)

## Rows: 28
## Columns: 24
## $ team_name        Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ id               1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ...
## $ minute           2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ result           Blocked Shot, GOAL, Blocked Shot, GOAL, GOAL, Saved...
## $ X                0.875, 0.885, 0.860, 0.842, 0.946, 0.734, 0.936, 0....
## $ Y                0.347, 0.500, 0.322, 0.607, 0.542, 0.374, 0.359, 0....
## $ xG               0.06855621, 0.76116884, 0.06080124, 0.05824600, 0.4...
## $ firstname        "Mohamed", "Mohamed", "Mohamed", "Jack", "Virgil", ...
## $ player           "Salah", "Salah", "Salah", "Harrison", "van Dijk", ...
## $ h_a              "h", "h", "h", "a", "h", "h", "h", "a", "h", "h", "...
## $ player_id        1250, 1250, 1250, 8720, 833, 605, 5247, 822, 1250, ...
## $ situation        "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ season           2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType         "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ match_id         14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team           "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team           "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ date             "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted  "Sadio Mané", NA, "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction       "Pass", NA, "Pass", "Take On", "Cross", "None", "No...
## $ team_color       "#d00027", "#d00027", "#d00027", "#1D428A", "#d0002...
## $ x                513.625, 519.495, 504.820, 494.254, 555.302, 430.85...
## $ y                129.431, 186.500, 120.106, 226.411, 202.166, 139.50...
## $ plot             [<1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17,...
```

I like to think of it as “KABOOM”-ing the “data” column so all its contents explode back out into your data frame.

Function to define specific shot map

This second plotting function takes the plots we created with the previous base shot map function and adds in the specific shot for each row to the base plot. The “plot” that is being passed into this function are all the plots we had saved in the “plot” column of the data frame. We add in a new `geom_point()` for the specific shot recorded in a row and make it bigger in size and color-coded according to the team to make it stand out from the rest of the shots the team took. At the bottom we add in a label for the xG value.

```
add_xG_shot <- function(x, y, xG, team_color, plot) {
  shotxG_map_point <-
    plot +
    # specific shot point in black and bold
    geom_point(x = x, y = y, aes(fill = team_color),
               size = 12, stroke = 3, shape = 21) +
    scale_fill_identity() +
    #scale_x_continuous(expand = c(0.01, 0)) +
    ## label for shot point
    geom_label(x = 318, y = 186.5,
               color = "black", size = 20,
               fill = "white", family = "Roboto Slab",
               label = glue::glue("{xG %>% round(digits = 2)} xG"))

  return(shotxG_map_point)
}
```

Combining plots to data frame

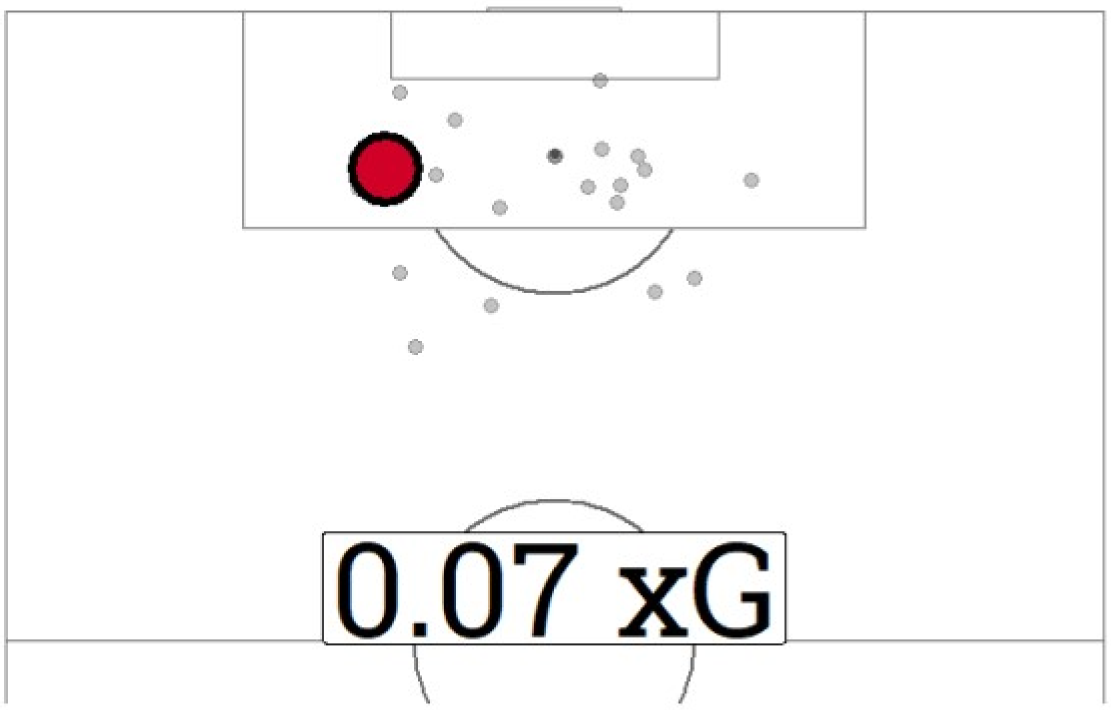
Now we finally work with the data frame that has the rolling xG sums. The IDs should match up with the IDs in `match_df_basic_plot` because the `roll_sum_df` data frame is just an expanded version of `match_df_basic_plot` that created empty rows for every minute. Once you `filter()` out those rows without an xG value the rows for both should match up. Be very careful when manipulating both of these data frames in previous steps as it can become very easy for the IDs to get messed up especially when there are multiple chances by either team in the same minute. Make sure the row order of the shots data frame is exactly as downloaded from understat.com before applying the IDs to the rows.

Since we have more than two arguments that we are passing to the `add_xG_shot()` function we need to iterate over every row using the `pmap()` function instead of `map2()`.

```
## map plot to df again with a shot point for each row/plot
dfdfdf <- match_df_basic_plot %>%
  ## shot-per-row, using 'plot' as base pass along the 'x', 'y' coordinates a
  ## to "add_xG_shot()` function for each row.
  ## have empty 'ggplot' column for gt plot-insertion purposes
  mutate(complete_plot = pmap(list(x, y, xG, team_color, plot), add_xG_shot),
         ggplot = NA) %>%
  select(-plot) %>%
  left_join(rollsum_df, by = "id")
```

We can check the data frame for the plot in the first row, which is the first shot in the game from Mo Salah in the 7th minute.

```
dfdfdf$complete_plot[[1]]
```



Now for a plot for a row where the team is Leeds United. You can see that the plot is different from the Liverpool one as the “grey”-ed out shots are Leeds’ other shots. This is because of what we did earlier in creating the “basic” shot map for each team separately.

```
dfdfdf$complete_plot[[4]]
```

Tidying up to prep for table creation

We are now very close to the data frame we need to start making the table.

```
glimpse(dfdfdf)
```

```
## Rows: 28
## Columns: 26
## $ team_name        Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ id               1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ...
## $ minute           2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ result           Blocked Shot, GOAL, Blocked Shot, GOAL, GOAL, Saved...
## $ X                0.875, 0.885, 0.860, 0.842, 0.946, 0.734, 0.936, 0....
## $ Y                0.347, 0.500, 0.322, 0.607, 0.542, 0.374, 0.359, 0....
## $ xG               0.06855621, 0.76116884, 0.06080124, 0.05824600, 0.4...
## $ firstname        "Mohamed", "Mohamed", "Mohamed", "Jack", "Virgil", ...
## $ player           "Salah", "Salah", "Salah", "Harrison", "van Dijk", ...
## $ h_a              "h", "h", "h", "a", "h", "h", "h", "a", "h", "h", "...
## $ player_id        1250, 1250, 1250, 8720, 833, 605, 5247, 822, 1250, ...
## $ situation        "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ season           2020, 2020, 2020, 2020, 2020, 2020, 2020, 2020, 202...
## $ shotType         "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ match_id         14090, 14090, 14090, 14090, 14090, 14090, 14090, 14...
## $ h_team           "Liverpool", "Liverpool", "Liverpool", "Liverpool",...
## $ a_team           "Leeds", "Leeds", "Leeds", "Leeds", "Leeds", "Leeds...
## $ date             "2020-09-12 16:30:00", "2020-09-12 16:30:00", "2020...
## $ player_assisted  "Sadio Mané", NA, "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction       "Pass", NA, "Pass", "Take On", "Cross", "None", "No...
## $ team_color       "#d00027", "#d00027", "#d00027", "#1D428A", "#d0002...
## $ x                513.625, 519.495, 504.820, 494.254, 555.302, 430.85...
## $ y                129.431, 186.500, 120.106, 226.411, 202.166, 139.50...
## $ complete_plot    [<1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17,...
## $ ggplot           NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,...
## $ rollsum_goal     0.06855621, 0.82972505, 0.89052629, 0.05824600, 1.3...
```

There are a lot of columns that we won't really need for the table so we'll do some final cleaning up before we get to the {gt} table code. We `select()` for the columns that hold the info that we really need and then make edits to `lastAction` column to clean them up a bit. We replace any `NA`s with a blank so they don't show up in the table as `NA` text. A new `player_name` column is created by concatenating the `firstname` and `player` (which contains the player's last name) columns into one. Finally we use the new `relocate()` function to place the newly created `player_name` column to be placed after the `team_name` column.

```
## data creation for actual table
match_shots_table_df <- dfdfdf %>%
  select(minute, team_name, result, xG, firstname, player,
         ggplot, complete_plot, rollsum = rollsum_goal,
         situation, type = shotType, player_assisted, lastAction) %>%
  ## player name labels, clean "lastAction"
  mutate(player_name = paste(firstname, player),
         lastAction = if_else(lastAction == "None", NA_character_, lastAction
         xG = xG %>% round(digits = 2),
         rollsum = rollsum %>% round(digits = 2)) %>%
  ## NAs as blanks
  mutate(across(where(is.character), ~ replace_na(., ""))) %>%
  ## take out extraneous name vars and move to after team name
  select(-firstname, -player) %>%
  relocate(player_name, .after = team_name)

glimpse(match_shots_table_df)
```

```
## Rows: 28
## Columns: 12
## $ minute          2, 3, 6, 11, 19, 24, 28, 29, 32, 39, 39, 48, 49, 52...
## $ team_name       Liverpool, Liverpool, Liverpool, Leeds, Liverpool, ...
## $ player_name     "Mohamed Salah", "Mohamed Salah", "Mohamed Salah", ...
## $ result          Blocked Shot, GOAL, Blocked Shot, GOAL, GOAL, Saved...
## $ xG              0.07, 0.76, 0.06, 0.06, 0.42, 0.02, 0.09, 0.06, 0.0...
## $ ggplot          NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,...
## $ complete_plot   [<1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17,...
## $ rollsum         0.07, 0.83, 0.89, 0.06, 1.31, 1.33, 1.42, 0.11, 1.4...
## $ situation       "Open Play", "Penalty", "Open Play", "Open Play", "...
## $ type            "Left Foot", "Left Foot", "Left Foot", "Right Foot"...
## $ player_assisted "Sadio Mané", "", "Sadio Mané", "Kalvin Phillips", ...
## $ lastAction      "Pass", "", "Pass", "Take On", "Cross", "", "", "",...
```

Code Breakdown (Part 3): The {gt} table!

Soccer ball emoji

To give rows where the shots are goals a bit of ‘oomph’ in the table, we will add a soccer ball emoji next to the all-caps “GOAL” text. We can add in the unicode version of the emoji as an object that we’ll then `paste()` into the text. From my attempts it only works well for the `.HTML` output and for the `.PNG` output I use for my regular match summary graphics I have to use a “star” emoji instead as the soccer ball one doesn’t render too well in `.PNG`.

```
soccer_ball <- "⚽"
```

Table Headline/Title & Team Logos

To start off, we add in the title and team logo images via HTML. Something very simple as getting the team logo images to be set to the side of the text took a looooonnggg time and many many iterations because I’m not very good at HTML/CSS but I got it done eventually…

You can define variables in text via `glue::glue()` and declaring variables inside `{}` so it can be customized depending on the match data you're passing in. For this example `home_stats$xG` will equal to `3.15` for Liverpool's xG but if we were running this for a different match with a different `home_stats` data frame it'll evaluate to a different xG value for the table title text automatically.

```
match_gt_xG_timeline <-
  gt(match_shots_table_df) %>%
  tab_header(
    title = gt::html(glue::glue("
```

home_team_logo({home_stats$xG} xG) **{home_stats$TEAMS}**

{home_stats$GOA

–

{away_stats$GOA

**{away_stats$TEAMS}** ({away_stats$xG} xG)

`{league_year}: Matchday {matchday} ({match_date})")))`

Table Text Style

Styling the individual cells of our {gt} table can be done via the `tab_style()` function. Throughout the titles and headers we use the font `Roboto Slab` which is a thicker version of the `Roboto Condensed` font that I use for nearly all of my visualizations.

First, we add some styling to the title text that we just created above. We can specify that the cells we want to style via the `locations` argument and setting that to "title" via the `cells_title()` function. For the actual styling via the `style` argument, we can specify font, weight, color, etc. via the `cell_text()` function.

For styling the column headers we specify the `location` with the `cells_column_labels()` function. The special `everything()` helper function (from the {tidyselect} package) is used as we want to specify the style for all column headers. We want the text in the column headers to stand out so we make them extra big by specifying the size to be `xx-large` and weight `bold`.

We also want to add some small vertical borders to the column headers so they are divided up, styles for borders can be specified via the `cells_borders()` function.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## title style
  tab_style(
    style = list(
      cell_text(
        font = "Roboto Slab",
        align = "center",
        weight = "bold",
        color = "#000000"
      )
    ),
    locations = list(
      cells_title(groups = "title")
    )
  ) %>%
  ## column style
  tab_style(
    style = list(
      cell_text(font = "Roboto Slab", align = "center",
                size = "xx-large", weight = "bold"),
      cell_borders(sides = c("left", "right"),
                   color = "grey20", weight = px(2))
    ),
    locations = list(
      cells_column_labels(everything())
    )
  )
```

Table Row Color Fill

To style the rows for either team we have to do a bit more in the `locations` argument of `tab_style()`. Using `filter()`-style syntax we specify the rows so that the `team_name` column matches the value of either the `home_team` (Liverpool) or `away_team` (Leeds United). For rows where Liverpool took a shot we fill the cells with `home_color` “red” and for Leeds `away_color` or “blue”. We specified the `home_color` and `away_color` variables at the beginning of the tutorial. When all of this code is turned into a function, you would have these variables set as arguments to the table-making function so you can easily specify any color hex code as needed.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## HOME TEAM
  tab_style(
    style = cell_fill(color = home_color),
    locations = cells_body(
      rows = team_name == home_team)
  ) %>%
  ## AWAY TEAM
  tab_style(
    style = cell_fill(color = away_color),
    locations = cells_body(
      rows = team_name == away_team)
  ) %>%
  ## all cell text
  tab_style(
    style = cell_text(color = "white", align = "center", size = "x-large",
                      font = "Roboto Condensed", weight = "bold"),
    locations = cells_body(
      columns = TRUE)
  )
```

Goal/Own Goal Rows

In this section of the {gt} code we go over the `text_transform()` function for doing two very different operations, for appending the soccer ball emoji unicode to the “GOAL” or “OWN GOAL” cells and for adding the shot maps we created earlier into the table.

We can use the `text_transform()` function to pass a inline function that appends the soccer ball emoji unicode next to either “GOAL” or “OWN GOAL” text via `paste()`. In specifying the exact location, we have the columns point to the “result” column and filter for rows that have “GOAL” or “OWN GOAL” in the respective “result” column.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## add Goal result emoji by pasting in the emoji next to the 'result' text
  text_transform(
    locations = cells_body(
      columns = vars(result),
      rows = result %in% c("GOAL", "OWN GOAL")),
    fn = function(x) paste(x, soccer_ball)
  )
```

Appending Shot Map Plots

To get our shot map plots to show up in the table we pass a different inline function to `text_transform()`. We can use the `ggplot_image()` helper function which generates an HTML fragment of a ggplot object. We `map()` the function over every row in the table to generate the shot maps for every row. The “height” and “aspect_ratio” arguments are passed along to `map()` to set the dimensions for the plot inside the cells of the table.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## add plots into the empty 'ggplot' column
  ## use `ggplot_image()` function and set height and aspect ratio
  text_transform(
    locations = cells_body(columns = vars(ggplot)),
    fn = function(x) {
      map(match_shots_table_df$complete_plot, ggplot_image, height = px(150),
    }
  )
```

Rename Columns

Using the `cols_label()` function we can easily re-name all of the column headers to a more table-friendly name. The `cols_align()` is used to align the text of columns.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## Rename cols
  cols_label(
    minute = "Minute", team_name = "Team", player_name = "Player",
    result = "Result", xG = "xG", rollsum = "Cumulative xG",
    ggplot = "Shot Map", situation = "Situation",
    type = "Shot Type", lastAction = "Assist Action", player_assisted = "Assi
  ) %>%
  cols_align("center")
```

Other Table Options & Source Notes

The `tab_options()` function is a very general function that gives you a lot of options for styles similar to `tab_style()` except without having to bother with specifying the location and such. For our purposes I'm using this to add a thick gray border at the top and bottom of the column headers. This can be done with `tab_style()` like we did for the "left" and "right" vertical borders but I didn't want to bother with the whole `tab_style()` syntax all over again. You could just add another `tab_style()` function and just specify the "sides" in `cells_borders()` to "top" and "bottom" if you want to do it that way. We make the top and bottom borders of the column labels a bit thicker to separate them from the title and the body of the table by setting the width to be `px(5)` (px stands for pixel).

The "data_row.padding" argument sets the amount of vertical padding to each row of the table while "source_notes.font.size" is fairly self-explanatory. We set the actual text for the source note via the `tab_source_note()` function. Instead of using HTML to style the text, we can use markdown via the `md()` function and style the text using regular markdown syntax.

Finally we use the `cols_hide()` function to hide the columns that we don't want to show.

```
match_gt_xG_timeline <-
  match_gt_xG_timeline %>%
  ## general table options
  tab_options(
    column_labels.border.top.color = "grey",
    column_labels.border.top.width= px(5),
    column_labels.border.bottom.color = "grey",
    column_labels.border.bottom.width= px(5),
    data_row.padding = px(15),
    source_notes.font.size = 20
  ) %>%
  tab_source_note(source_note = md(source_text)) %>%
  cols_hide(vars(complete_plot, xG))
```

Complete function

We can wrap this all up in a neat function that takes a few useful and flexible arguments so that we can use the code and apply it to other matches. We'll use the inputs we created up to Part 1 as the arguments to pass to the function, the function will contain all the code from **Part 2** and **Part 3**.

```
home_team = "Liverpool"
away_team = "Leeds"
home_color = "#d00027"
away_color = "#1D428A"
match_date <- "Sep. 12, 2020"
league_year <- "Premier League 2020-2021"
matchday <- 1
source_text <- "**Table**: Ryo Nakagawara (**Twitter**: @R_by_Ryo) | **Data**

## shots_df, rollsum_df, home_stats, away_stats are all created in Part 1!

create_timeline_table <- function(shots_df, rollsum_df, home_stats, away_stat
                                  home_team, away_team, home_color, away_colo
                                  match_date, league_year, matchday,
                                  source_text) {

  pitch_custom <- list(
    length = 587,
    width = 373,
    penalty_box_length = 101,
    penalty_box_width = 211,
    six_yard_box_length = 31,
    six_yard_box_width = 111,
    penalty_spot_distance = 66,
    goal_width = 45,
    origin_x = 0,
    origin_y = 0)

  ## create coords
  match_df <- shots_df %>%
    ## switch coordinates for vertical view
    mutate(
      x = case_when(
        h_a == "a" ~ X * 587,
        h_a == "h" ~ X * 587,
        TRUE ~ 0),
      y = case_when(
        h_a == "a" ~ Y * 373,
        h_a == "h" ~ Y * 373,
        TRUE ~ 0)) %>%
    ## edit result values
    mutate(result = case_when(
      result == "Goal" ~ "GOAL",
      result == "Own Goal" ~ "OWN GOAL",
      TRUE ~ result)) %>%
    mutate(result = forcats::as_factor(result),
           result = forcats::fct_relevel(result, "GOAL", "Saved Shot",
                                         "On Post", "Blocked Shot",
                                         "Missed Shots", "OWN GOAL"))

  create_shotmap_basic <- function(df = data, team_name = team_name) {

    shotxG_map_raw <-
      ggplot(df %>% filter(team_name == team_name),
             aes(x = x, y = y)) +
      annotate_pitch(dimensions = pitch_custom) +
      ## all shots in grey and transparent
      geom_point(aes(x = x, y = y), color = "grey20",
                 size = 3, alpha = 0.3) +
      #scale_x_continuous(expand = c(0.01, 0)) +
      theme_pitch(aspect_ratio = 373/587) +
      coord_flip(xlim = c(280, 590),
                 ylim = c(10, 365)) +
      theme(plot.margin = unit(c(0.1, 0.1, 0.1, 0.1), "pt"),
            text = element_markdown(family = "Roboto Condensed"),
            legend.position = "none")

    return(shotxG_map_raw)
  }

  ## add blank shot map to all rows
  match_df_basic_plot <- match_df %>%
    tibble::as_tibble() %>%
    ## nest by team
    group_by(team_name) %>%
    nest() %>%
    ## apply plots for all shots per team, for each row in their respective "
    mutate(plot = map2(data, team_name, create_shotmap_basic)) %>%
    ungroup() %>%
    unnest(cols = "data") %>%
    arrange(id)

  add_xG_shot <- function(x, y, xG, team_color, plot) {
    shotxG_map_point <-
      plot +
      # specific shot point in black and bold
      geom_point(x = x, y = y, aes(fill = team_color),
                 size = 12, stroke = 3, shape = 21) +
      scale_fill_identity() +
      #scale_x_continuous(expand = c(0.01, 0)) +
      ## label for shot point
      geom_label(x = 318, y = 186.5,
                 color = "black", size = 20,
                 fill = "white", family = "Roboto Slab",
                 label = glue::glue("{xG %>% round(digits = 2)} xG"))

    return(shotxG_map_point)
  }

  ## map plot to df again with a shot point for each row/plot
  dfdfdf <- match_df_basic_plot %>%
    ## shot-per-row, using 'plot' as base pass along the 'x', 'y' coordinates
    ## to "add_xG_shot()` function for each row.
    ## have empty 'ggplot' column for gt plot-insertion purposes
    mutate(complete_plot = pmap(list(x, y, xG, team_color, plot), add_xG_shot
           ggplot = NA) %>%
    select(-plot) %>%
    left_join(rollsum_df, by = "id")

  ## data creation for actual table
  match_shots_table_df <- dfdfdf %>%
    select(minute, team_name, result, xG, firstname, player,
           ggplot, complete_plot, rollsum = rollsum_goal,
           situation, type = shotType, player_assisted, lastAction) %>%
    ## player name labels, clean "lastAction"
    mutate(player_name = paste(firstname, player),
           lastAction = if_else(lastAction == "None", NA_character_, lastActi
           xG = xG %>% round(digits = 2),
           rollsum = rollsum %>% round(digits = 2)
    ) %>%
    ## NAs as blanks
    mutate(across(where(is.character), ~ replace_na(., ""))) %>%
    ## take out extraneous name vars and move to after team name
    select(-firstname, -player) %>%
    relocate(player_name, .after = team_name)

  ## TABLE!!!
  soccer_ball <- "⚽"

  match_gt_xG_timeline <-
    gt(match_shots_table_df) %>%
      tab_header(
    title = gt::html(glue::glue("
```

home_team_logo ({home_stats$xG} xG) {home_stats$TEAMS}

{home_stats$GOA

{away_stats$GOA
{away_stats$TEAMS} ({away_stats$xG} xG)
{league_year}: Matchday
{matchday} ({match_date})"))) %

```
  ## title style
  tab_style(
    style = list(
      cell_text(
        font = "Roboto Slab",
        align = "center",
        weight = "bold",
        color = "#000000"
      )
    ),
    locations = list(
      cells_title(groups = "title")
    )
  ) %>%
  ## column style
  tab_style(
    style = list(
      cell_text(font = "Roboto Slab", align = "center",
                size = "xx-large", weight = "bold"),
      cell_borders(sides = c("left", "right"),
                   color = "grey20", weight = px(2))
    ),
    locations = list(
      cells_column_labels(everything())
    )
  ) %>%
  ## HOME TEAM
  tab_style(
    style = cell_fill(color = home_color),
    locations = cells_body(
      rows = team_name == home_team)
  ) %>%
  ## AWAY TEAM
  tab_style(
    style = cell_fill(color = away_color),
    locations = cells_body(
      rows = team_name == away_team)
  ) %>%
  ## all cell text
  tab_style(
    style = cell_text(color = "white", align = "center", size = "x-large",
                      font = "Roboto Condensed", weight = "bold"),
    locations = cells_body(
      columns = TRUE)
  ) %>%
    ## add Goal result emoji by pasting in the emoji next to the 'result' tex
    text_transform(
      locations = cells_body(
        columns = vars(result),
        rows = result %in% c("GOAL", "OWN GOAL")),
      fn = function(x) paste(x, soccer_ball)
    ) %>%
    ## add plots into the empty 'ggplot' column
    ## use `ggplot_image()` function and set height and aspect ratio
    text_transform(
      locations = cells_body(columns = vars(ggplot)),
      fn = function(x) {
        map(match_shots_table_df$complete_plot, ggplot_image, height = px(150
2)
      }
    ) %>%
    ## Rename cols
    cols_label(
      minute = "Minute", team_name = "Team", player_name = "Player",
      result = "Result", xG = "xG", rollsum = "Cumulative xG",
      ggplot = "Shot Map", situation = "Situation",
      type = "Shot Type", lastAction = "Assist Action", player_assisted = "As
    ) %>%
    cols_align("center") %>%
    ## general table options
    tab_options(
      column_labels.border.top.color = "grey",
      column_labels.border.top.width= px(5),
      column_labels.border.bottom.color = "grey",
      column_labels.border.bottom.width= px(5),
      data_row.padding = px(15),
      source_notes.font.size = 20
    ) %>%
    tab_source_note(source_note = md(source_text)) %>%
    cols_hide(vars(complete_plot, xG))

  return(match_gt_xG_timeline)
}

match_gt_xG_timeline <- create_timeline_table(shots_df, rollsum_df, home_stat
                                              home_team, away_team, home_colo
                                              home_team_logo, away_team_logo,
                                              match_date, league_year, matchd
                                              source_text)

match_gt_xG_timeline
```

- Full Image Link

Save Online to RPubs

Taking the first three letters of the home and away team via `str_sub()` and then pasting them in to the file name with `glue()` we can save our table with the `gtsave()` function with a uniform naming style. If you want to save tables for an entire team's matches in a season I recommend you put the Match Day number or some other identifier first so you can sort it nicely in a folder.

```
hom <- str_sub(home_stats$TEAMS, 1, 3)
awa <- str_sub(away_stats$TEAMS, 1, 3)

## Save the table in the RMD/output folder in your directory or whatever path
gtsave(match_gt_xG_timeline, here::here(glue("RMD/output/{hom}{awa}_match_gt_
```

Alternatively you can upload it directly to your RPub account on the web using `markdown::rpubsUpload()`. It'll direct you to the RPubs website where you'll be required to log-in or create an account. It's free and its a nice place to host your R web related stuff. Most people use it to host their presentations or analyses notebooks.

```
markdown::rpubsUpload(title = title = glue::glue("gt-{hom}{awa}_match_gt_shot
                              htmlFile = here::here(glue("RMD/output/{hom}{awa}_match
html")))
```

Examples (Full Image & Code)

We can run the same function for other matches from understat. You can modify the inputs/code a bit and use your own data or other data sources as well. Below is a screen shot, links to both the **full** table image and the code to create examples for other matches.

El Clasico: Barcelona vs. Real Madrid

- Full Image Link
- Code link

Inter Milan vs. Fiorentina

- Full Image Link
- Code link

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