POST MATCH SUMMARY REPORT
Barcelona–Girona La Liga 10.12.2023

Table of contents

Match Preview 1
Head 2 Head 2
Pre Match Odds 3
A.Dovbyk Score 4
Match Summary - Key Statistics 4
Attempts at Goal 10
Passes Flow 19
Passes Networks 22
Cumulative xG 30
Radar chart 34
Comparison of player statistics 44

Match Preview

```
from IPython.display import Image, display
display(Image(filename='img/weather.png', embed=True))
```

Head 2 Head

```
display(Image(filename='img/club_stats.png', embed=True))
```

All tournaments

Girona FC (Girona)		Fútbol Club Barcelona (Barcelona)	
Current UEFA rank (2018)	-	Current UEFA rank (2018)	3
Matches	7	Matches	7
Wins	1	Wins	4
Drawn	2	Drawn	2
Losses	4	Losses	1
Goals for	7	Goals for	16
Goals after	16	Goals after	7
Goals difference	-9	Goals difference	9
The biggest win	4:2	The biggest win	6:1
The biggest loss	1:6	The biggest loss	2:4
The most resultative match	1:6	The most resultative match	6:1
The most resultative draw	2:2	The most resultative draw	2:2
Points	5	**Points**	14

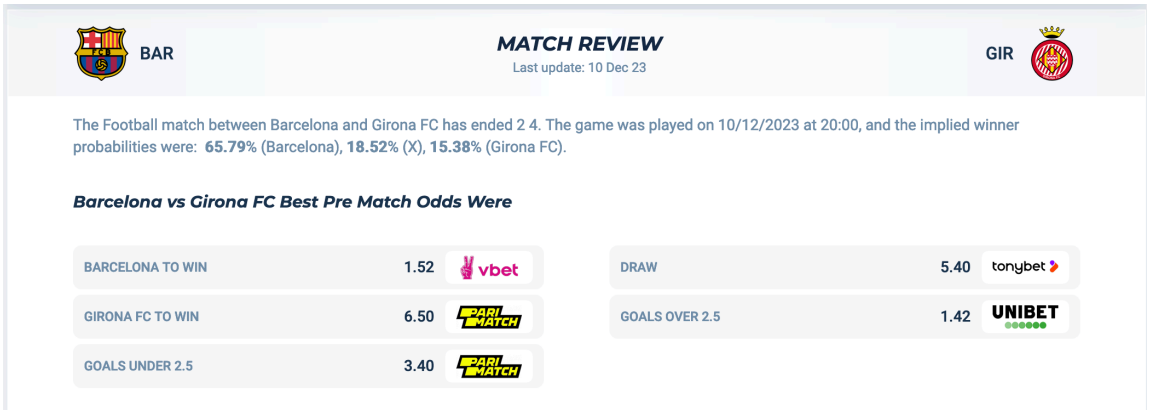
```
display(Image(filename='img/history2.png', embed=True))
```

Matches

Spain 2023/24, Primera			
05.05.2024	Girona – Barcelona		
Girona			Estadi Montilivi
Spain 2023/24, Primera			
10.12.2023	Barcelona – Girona		2:4 (1:2)
Barcelona			Estadi Olímpic Lluís Companys
Spain 2022/23, Primera			
10.04.2023	Barcelona – Girona		0:0
Barcelona			Camp Nou
Spain 2022/23, Primera			
28.01.2023	Girona – Barcelona		0:1 (0:0)
Girona			Estadi Montilivi
Spain 2018/19, Primera			
27.01.2019	Girona – Barcelona		0:2 (0:1)
Girona			Estadi Montilivi
Spain 2018/19, Primera			
23.09.2018	Barcelona – Girona		2:2 (1:1)
Barcelona			Camp Nou
Spain 2017/18, Primera			
24.02.2018	Barcelona – Girona		6:1 (4:1)
Barcelona			Camp Nou
Spain 2017/18, Primera			
23.09.2017	Girona – Barcelona		0:3 (0:1)
Girona			Estadi Montilivi

Pre Match Odds

```
display(Image(filename='img/odds.png', embed=True))
```



A.Dovbyk Score

Opponent	Date	Position	Mins	Goals	Assists	Yel	Red	Shots	PS%	AerialsWon	Rating
Sevilla (H) 5 - 1	21-01-2024	FW	73	3	-	-	-	3	68.8	3	9.70
Almeria (A) 0 - 0	14-01-2024	FW	67	-	-	-	-	-	44.4	-	6.09
Atletico Madrid (H) 4 - 3	03-01-2024	FW	67	-	1	-	-	2	63.6	2	7.37
Real Betis (A) 1 - 1	21-12-2023	FW	64	1	-	1	-	1	90	1	6.92
Deportivo Alaves (H) 3 - 0	18-12-2023	FW	90	2	-	-	-	4	66.7	2	8.20
Barcelona (A) 2 - 4	10-12-2023	FW	73	1	-	-	-	2	76.2	1	7.07
Valencia (H) 2 - 1	02-12-2023	FW	90	-	-	-	-	1	87.5	1	6.35
Rayo Vallecano (A) 1 - 2	11-11-2023	FW	78	1	-	-	-	7	33.3	3	7.48
Osasuna (A) 2 - 4	04-11-2023	FW	85	1	2	-	-	4	76.9	2	8.60
Celta Vigo (H) 1 - 0	27-10-2023	FW	67	-	-	-	-	2	60	-	6.12
Almeria (H) 5 - 2	22-10-2023	FW	67	2	-	-	-	3	100	1	8.28
Cadiz (A) 0 - 1	07-10-2023	FW	72	-	-	-	-	-	75	1	6.67
Real Madrid (H) 0 - 3	30-09-2023	FW	60	-	-	-	-	1	83.3	1	6.06
Villarreal (A) 1 - 2	27-09-2023	FW	69	1	-	-	-	6	71.4	2	7.47
Mallorca (H) 5 - 3	23-09-2023	FW	61	1	1	-	-	4	76.9	1	8.19
Granada (A) 2 - 4	18-09-2023	FW	71	-	1	-	-	2	80	1	7.25
Las Palmas (H) 1 - 0	03-09-2023	Sub	29	-	-	-	-	2	75	-	6.35
Sevilla (A) 1 - 2	26-08-2023	Sub	27	-	-	-	-	2	25	1	5.76
Getafe (H) 3 - 0	20-08-2023	Sub	19	-	-	-	-	1	75	-	6.18
Real Sociedad (A) 1 - 1	12-08-2023	Sub	26	1	-	-	-	1	25	1	7.15

Mins: Minutes played *Goals: Total goals* *Assists: Total assists*
Yel: Yellow card *Red: Red card* *Shots: Total shots*
PS%: Pass success percentage *AerialsWon: Aerial duels won*

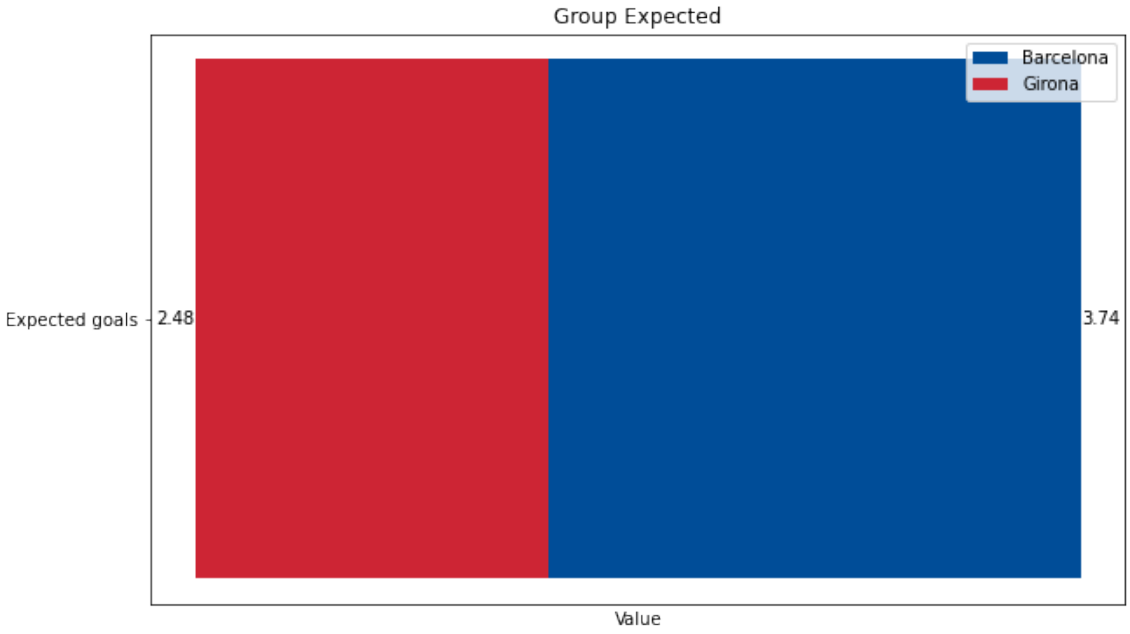
Figure 1: Dovbyk2.png

Match Summary - Key Statistics

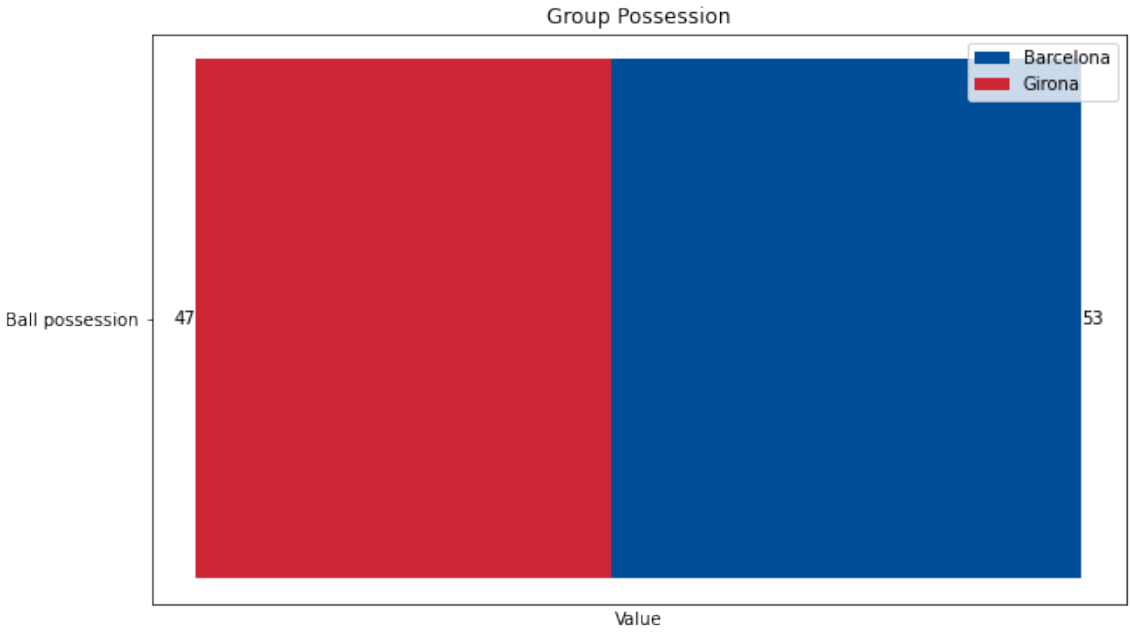
```
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np

import json
import re


# Load data from the sofascore file
with open('data/merged_match_data.json', 'r') as f:
    match_statistics = json.load(f)
```

```
def show_stats_data(group):
    labels = []
    first_team_values = []
    second_team_values = []

    for sub_item in group['statisticsItems']:
        labels.append(sub_item['name'])
        first_team_values.append(sub_item['homeValue'])
        second_team_values.append(sub_item['awayValue'])

    fig, ax = plt.subplots(figsize=(10, 6))

    p1 = ax.barh(labels, first_team_values, color='#004D98', label='Barcelona')
    p2 = ax.barh(labels, [-val for val in second_team_values], color='#cd2534', label='Giro

    for rect in p1:
        width = rect.get_width()
        ax.text(width, rect.get_y() + rect.get_height() / 2, f'{round(width, 2)}', ha='left

    for rect in p2:
        width = rect.get_width()
        ax.text(width, rect.get_y() + rect.get_height() / 2, f'{round(-width, 2)}', ha='rig

    ax.legend()
    ax.set_xlabel('Value')
    ax.set_title(f'Group {group["groupName"]}')
    # Remove x-axis ticks
    ax.set_xticks([])

    #plt.show()
```

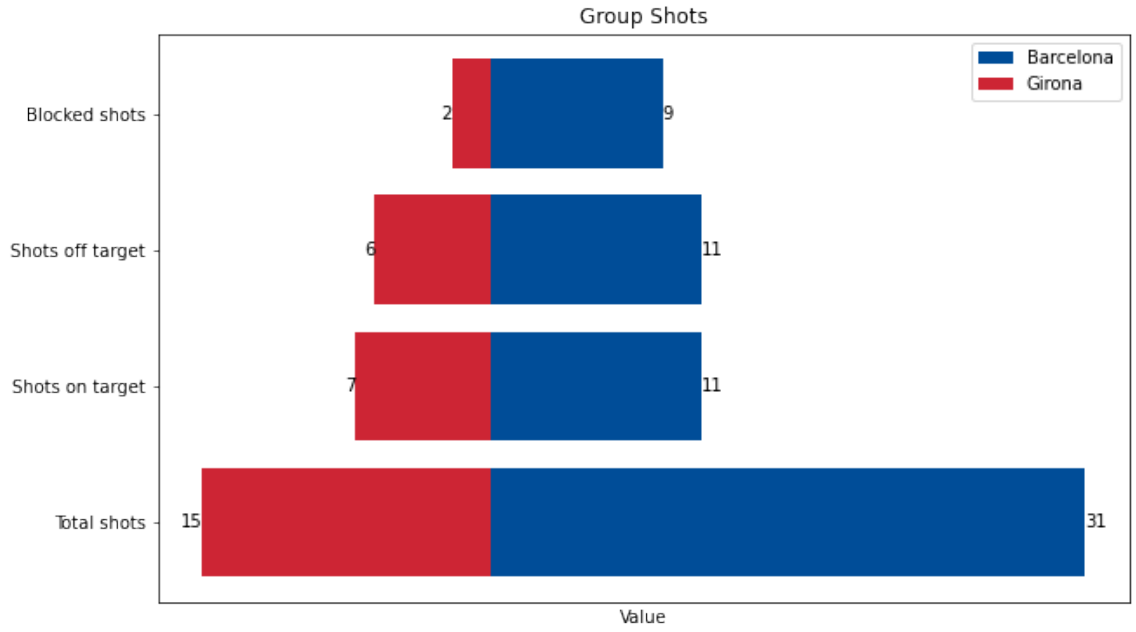
```
show_stats_data(match_statistics['0']['statistics'][0])
```



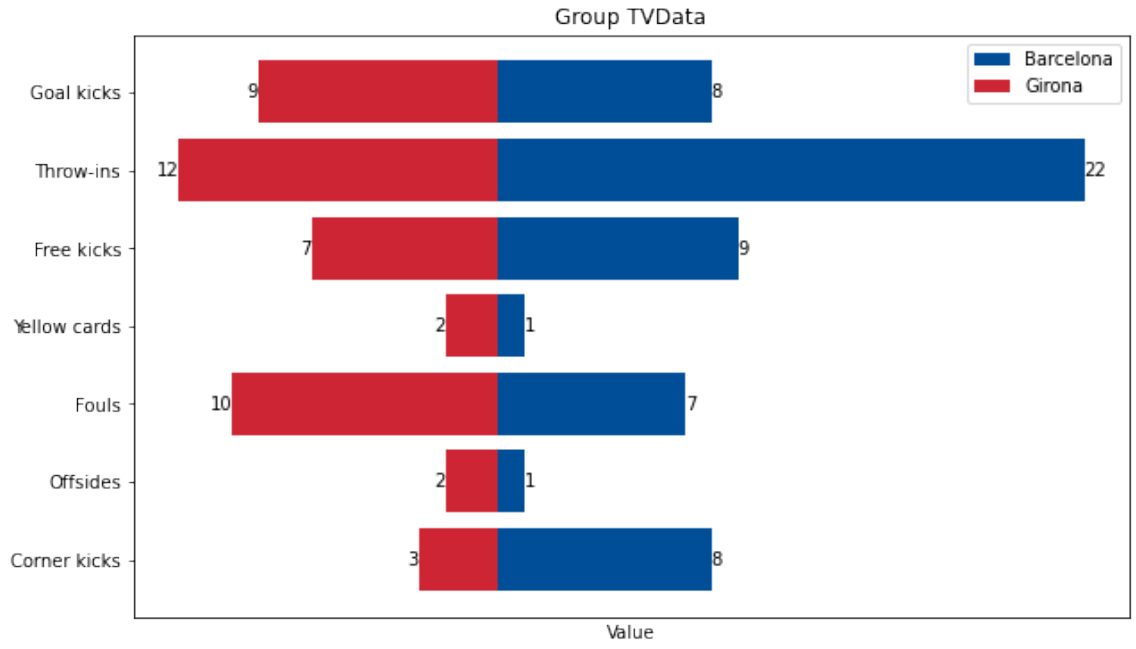

```
# Assuming your JSON is stored in a variable named 'match_statistics'
show_stats_data(match_statistics['0']['statistics'][1])
```



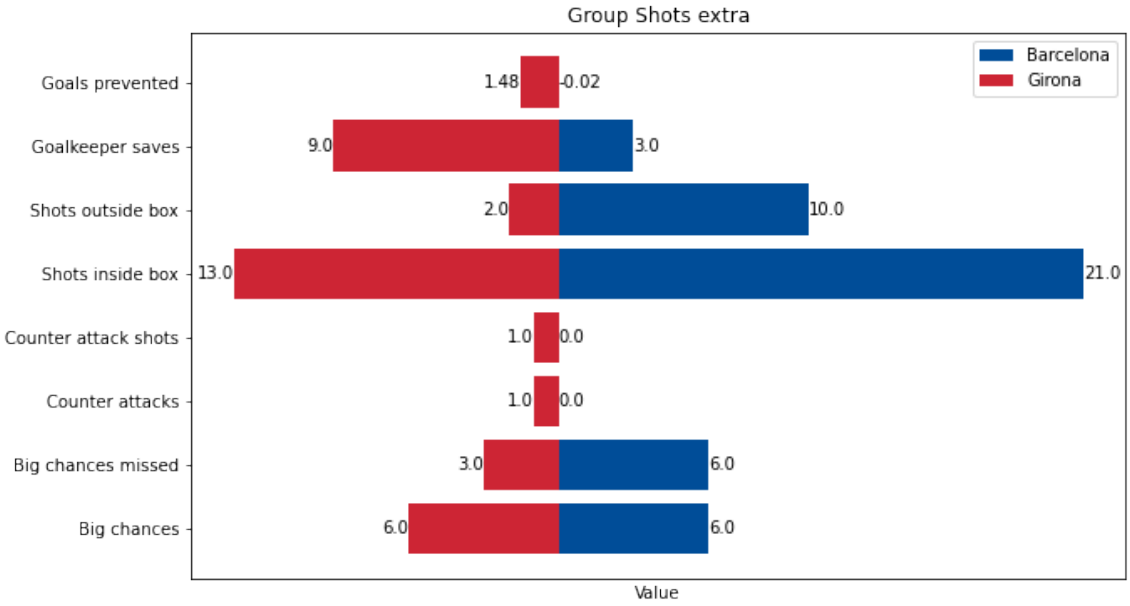

```
show_stats_data(match_statistics['0']['statistics'][2])
```



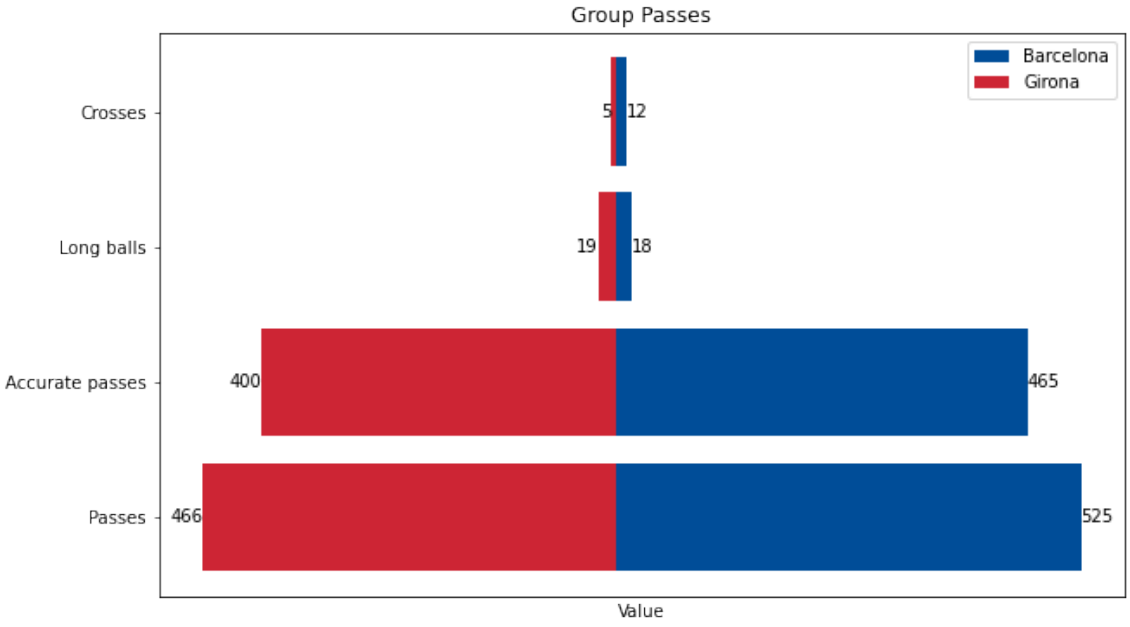

```
show_stats_data(match_statistics['0']['statistics'][3])
```



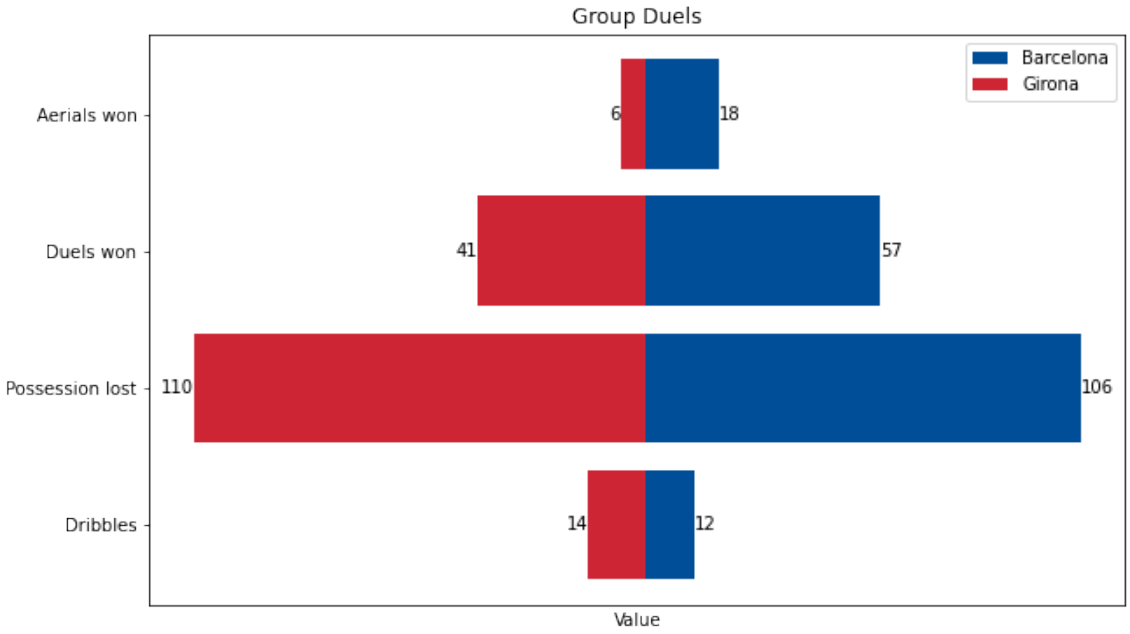

```
show_stats_data(match_statistics['0']['statistics'][4])
```



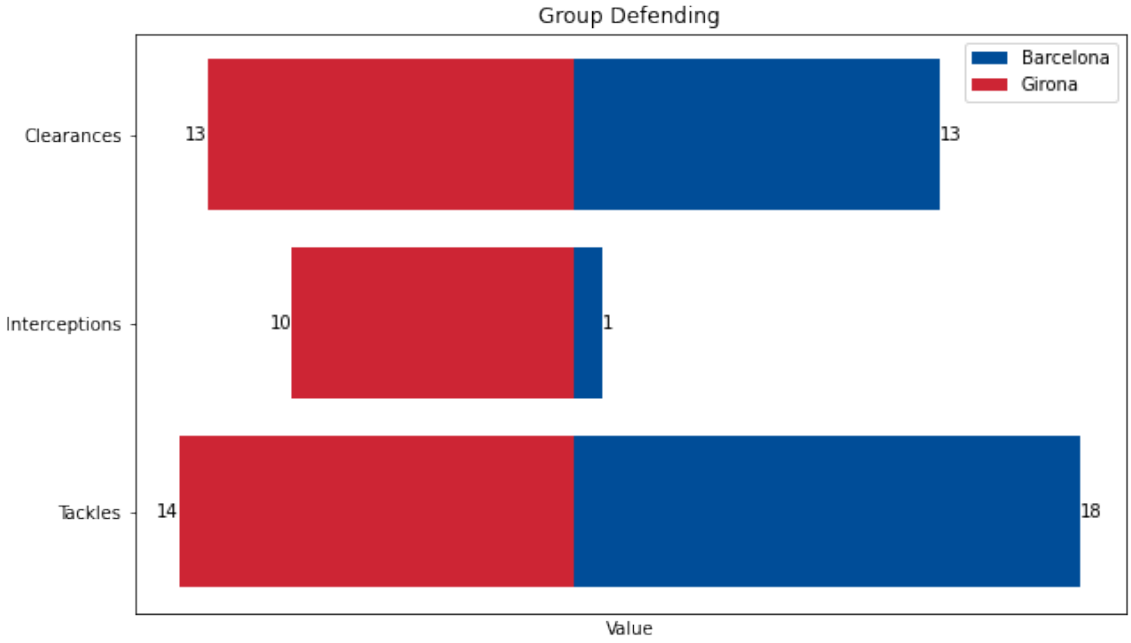

```
show_stats_data(match_statistics['0']['statistics'][5])
```



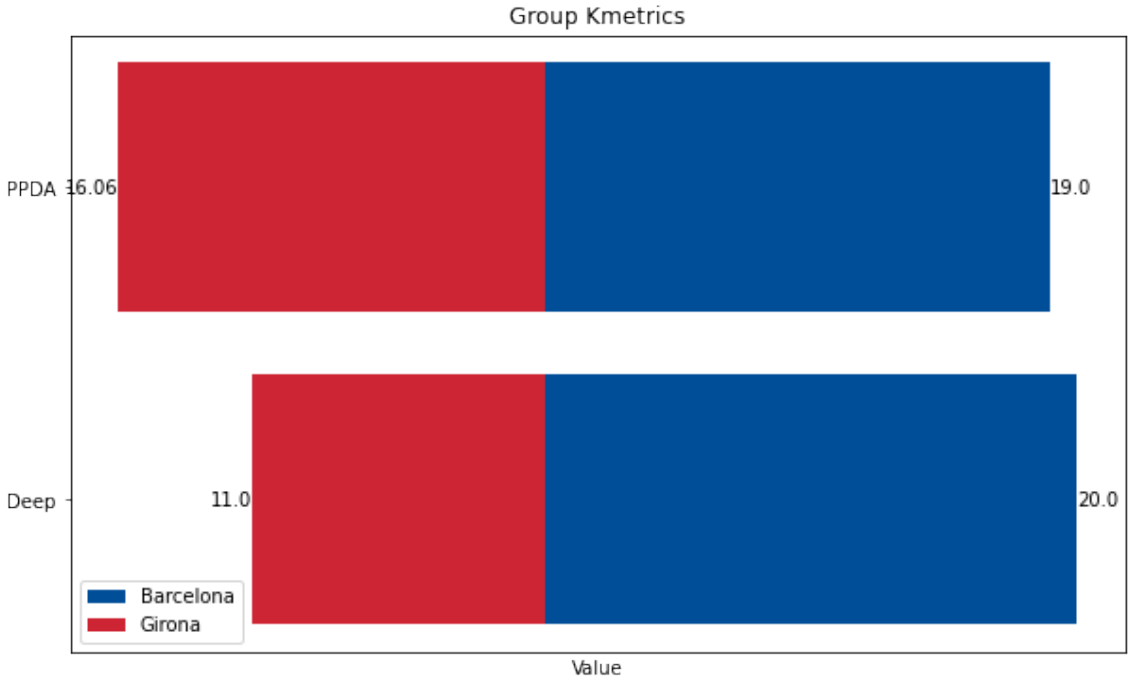

```
show_stats_data(match_statistics['0']['statistics'][6])
```




```
show_stats_data(match_statistics['0']['statistics'][7])
```




```
show_stats_data(match_statistics['0']['statistics'][8])
```



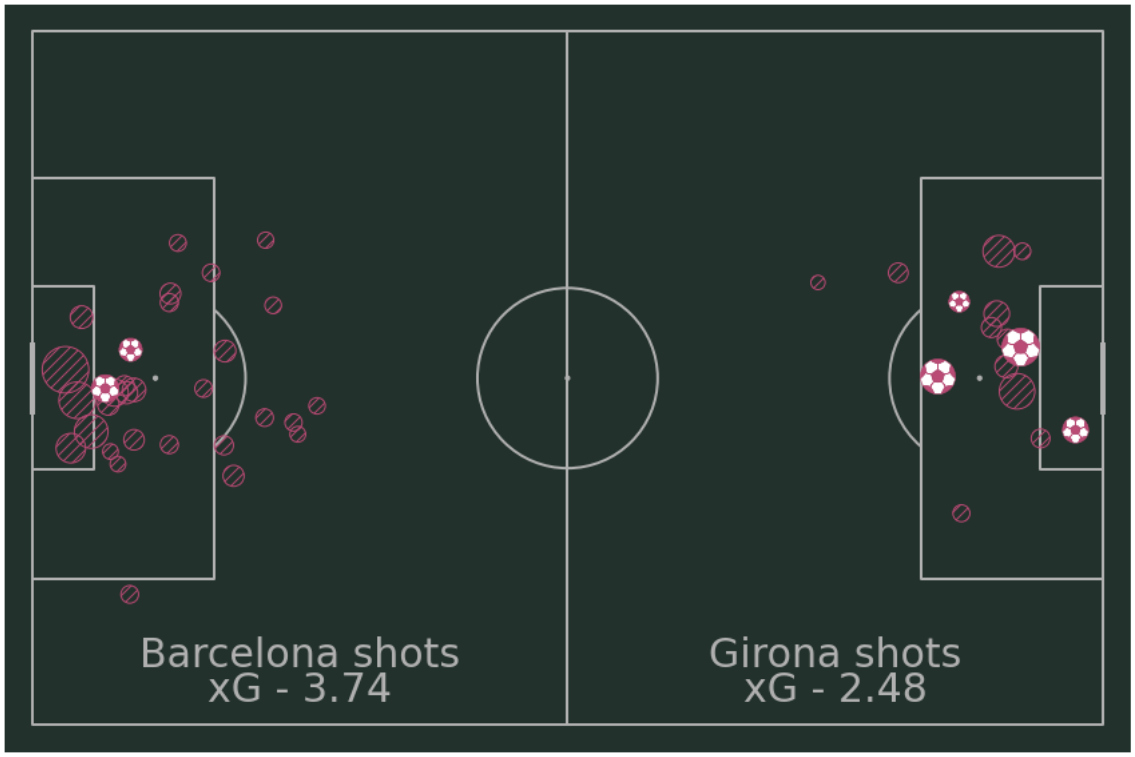
Attempts at Goal

```
import numpy as np
import matplotlib.pyplot as plt
from mplsoccer import Pitch
from mplsoccer.pitch import VerticalPitch


import json

# Load data from the sofascore file
with open('data/sofascore/shots.json', 'r') as f:
    shotmap_data = json.load(f)
```

```
# Extract shot data for Girona
shots = shotmap_data['shotmap']

# Create an mplsoccer Pitch
pitch = Pitch(pitch_type='opta', pitch_color='#22312b')

# Plot the shots on the pitch
fig, ax = pitch.draw(figsize=(12, 10))
```

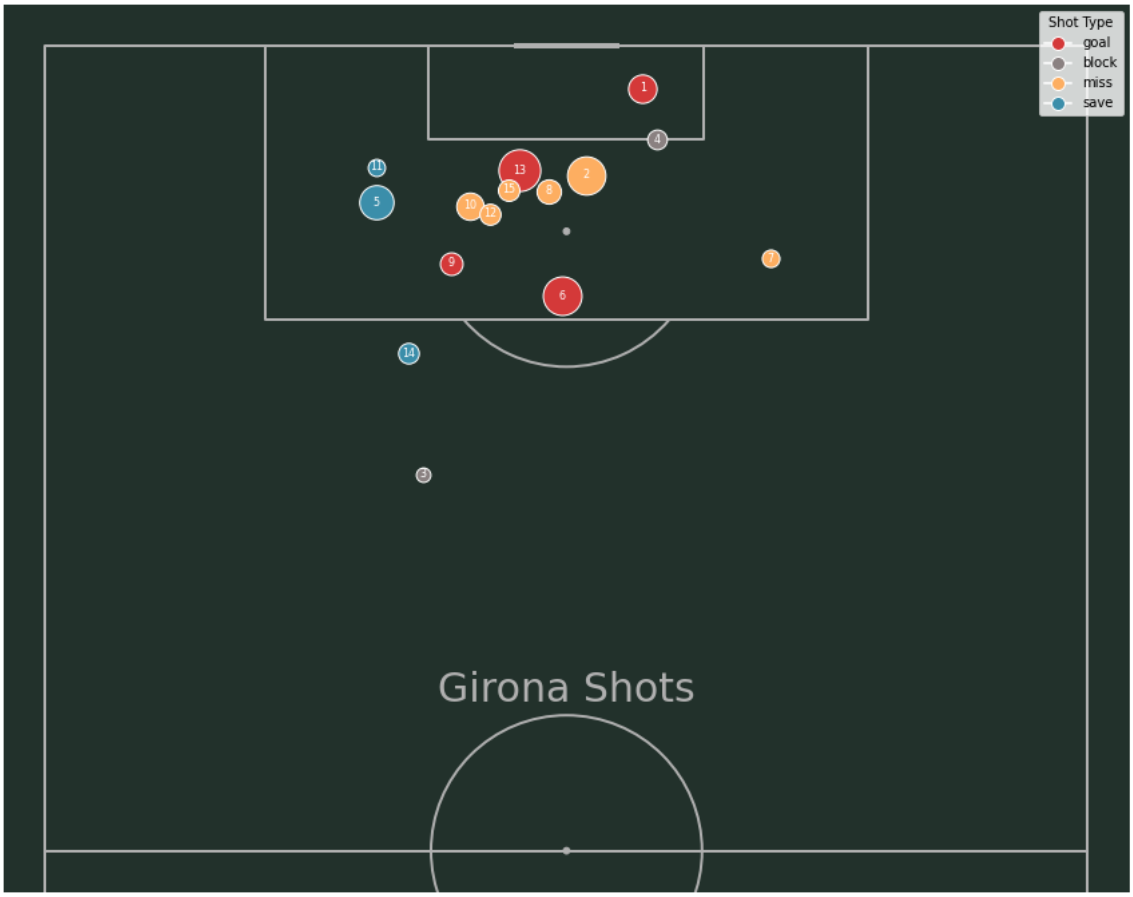
```
# Separate goal and non-goal shots for Girona at away games
girona_goal_shots = [shot for shot in shots if shot['isHome'] == False and shot['shotType']
girona_non_goal_shots = [shot for shot in shots if shot['isHome'] == False and shot['shotTy

# Plot Girona non-goal shots with hatch
for shot in girona_non_goal_shots:
    x = 100 - shot['playerCoordinates']['x']
    y = 100 - shot['playerCoordinates']['y']
    xg = shot['xg']

    pitch.scatter(x, y, s=(xg * 1600) + 100, edgecolors='#b94b75', c='None', hatch='///', m

# Plot Girona goal shots with a color
for shot in girona_goal_shots:
    x = 100 - shot['playerCoordinates']['x']
    y = 100 - shot['playerCoordinates']['y']
    xg = shot['xg']

    pitch.scatter(x, y, s=(xg * 1600) + 100, edgecolors='#b94b75', linewidths=0.6, c='white

# Separate goal and non-goal shots for Barcelona at home games
barcelona_goal_shots = [shot for shot in shots if shot['isHome'] == True and shot['shotType
barcelona_non_goal_shots = [shot for shot in shots if shot['isHome'] == True and shot['shot

# Plot Barcelona non-goal shots with hatch
for shot in barcelona_non_goal_shots:
    x = shot['playerCoordinates']['x']
    y = shot['playerCoordinates']['y']
    xg = shot['xg']

    pitch.scatter(x, y, s=(xg * 1600) + 100, edgecolors='#b94b75', c='None', hatch='///', m

# Plot Barcelona goal shots with a color
for shot in barcelona_goal_shots:
    x = shot['playerCoordinates']['x']
    y = shot['playerCoordinates']['y']
    xg = shot['xg']

    pitch.scatter(x, y, s=(xg * 1600) + 100, edgecolors='#b94b75', linewidths=0.6, c='white

# Add title
txt = ax.text(x=25, y=10, s='Barcelona shots', size=30, color=pitch.line_color, va='center'
txt = ax.text(x=75, y=10, s='Girona shots', size=30, color=pitch.line_color, va='center', h
txt = ax.text(x=25, y=5, s='xG - 3.74', size=30, color=pitch.line_color, va='center', ha='c
```

```
txt = ax.text(x=75, y=5, s='xG - 2.48', size=30, color=pitch.line_color, va='center', ha='c

plt.show()
```



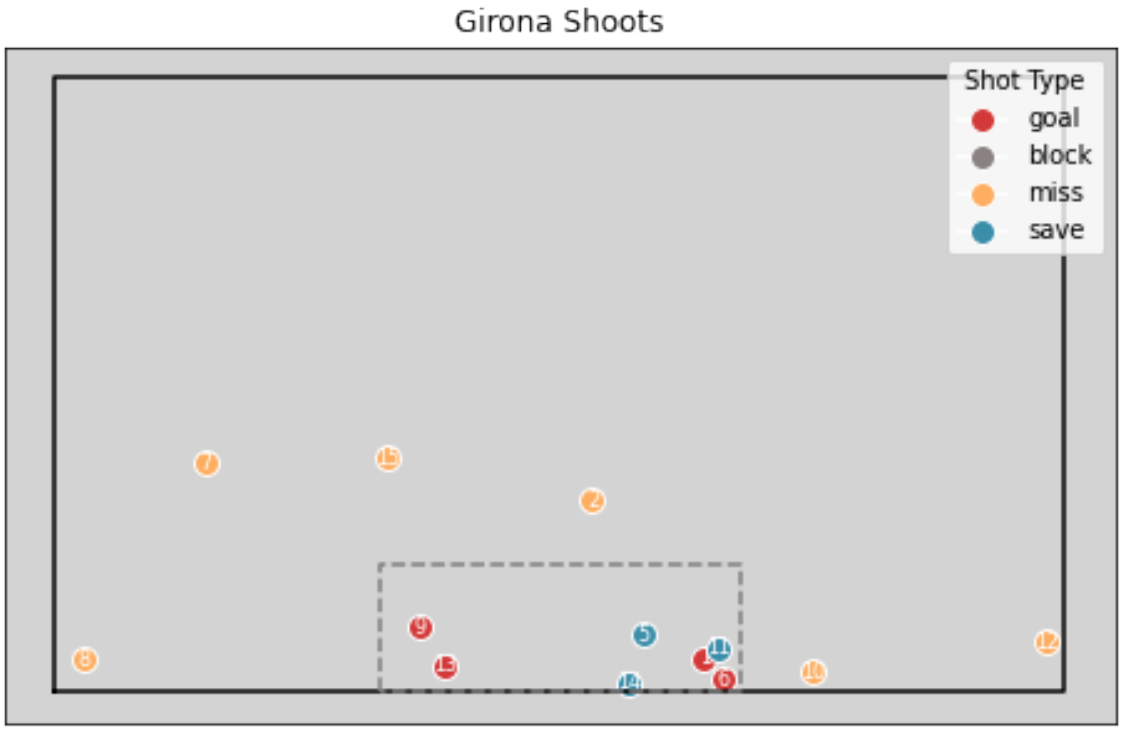

```
# Extract shot data for Girona
girona_shots = shotmap_data['shotmap']

# Create an mplsoccer Pitch
pitch = VerticalPitch(pitch_type='opta', pitch_color='#22312b', half=True)

# Plot the shots on the pitch
fig, ax = pitch.draw(figsize=(12, 10))

# Dictionary to map shot types to colors
shot_type_colors = {
    'goal': '#d43939',
    'block': '#8a8181',
    'miss': '#fdae61',
    'save': '#3b8eaa'
}

# Separate goal and non-goal shots for Girona at away games
```

```
girona_goal_shots_away = [shot for shot in girona_shots if shot['isHome'] == False]


# Plot non-goal shots with hatch
for i, shot in enumerate(girona_goal_shots_away):
    x = 100 - shot['playerCoordinates']['y']
    y = 100 - shot['playerCoordinates']['x']
    xg = shot['xg']
    shot_type = shot['shotType']

    color = shot_type_colors.get(shot_type)

    ax.scatter(x, y, s=(xg * 1900) + 100, edgecolors='white', c=color, marker='o')
    ax.text(x, y, s=str(i+1), color='white', ha='center', va='center', fontsize=8)

# Add title
txt = ax.text(x=50, y=60, s='Girona Shots', size=30, color=pitch.line_color, va='center', h

# Add legend for shot types
legend_elements = [plt.Line2D([0], [0], marker='o', color='w', label=shot_type, markerfacec
ax.legend(handles=legend_elements, loc='upper right', title='Shot Type')


plt.show()
```



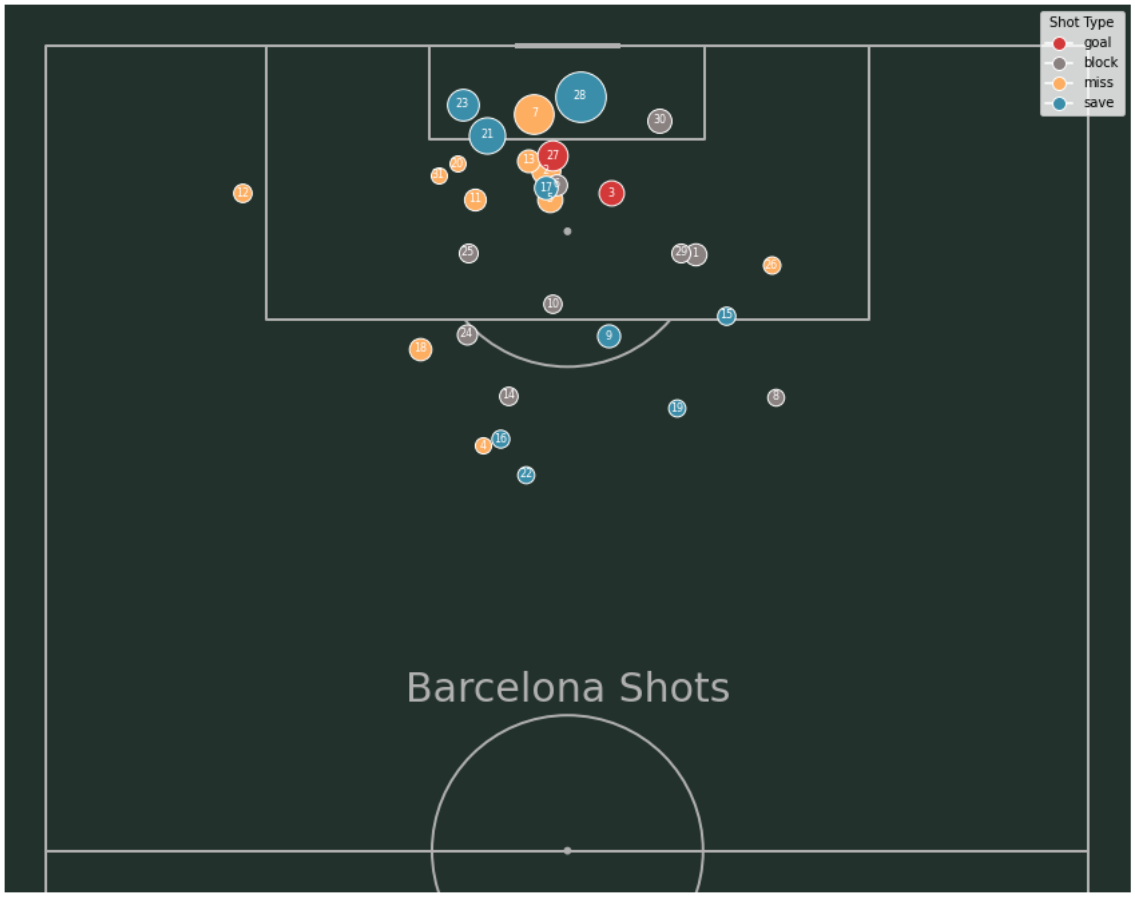

```
# Extract shot data for Girona
shots = shotmap_data['shotmap']
# Create a function to plot the football goal, shots, and goal area
def plot_goal_shots_and_area(shotmap_data):

    # Create a football goal plot
    fig, ax = plt.subplots(figsize=(8, 5))
    ax.set_facecolor('lightgrey')  # Set background color
    ax.plot([-20, -20, 120, 120, -20], [0, 120, 120, 0, 0], color='black')  # Football goal

    girona_shots = [shot for shot in shotmap_data if shot['isHome'] == False]


    # Scatter shots on the goal for non-home shots
    for i, shot in enumerate(girona_shots):
        if shot['shotType'] != 'block':
            goal_coordinates = shot['draw']['goal']
            shot_type = shot['shotType']
            color = shot_type_colors.get(shot_type)
```

```
            if (50 - goal_coordinates['x']) >= 0:
                ax.scatter(50 - ((50 - goal_coordinates['x'])*5), (100 - goal_coordinates['
                ax.text(50 - ((50 - goal_coordinates['x'])*5), (100 - goal_coordinates['y']
            else:
                ax.scatter(50 + (abs((50 - goal_coordinates['x']))*5), (100 - goal_coordina
                ax.text(50 + (abs((50 - goal_coordinates['x']))*5), (100 - goal_coordinates

    # Draw the football goal area
    goal_area_x = [25, 25, 75, 75, 25]
    goal_area_y = [0, 25, 25, 0, 0]
    ax.plot(goal_area_x, goal_area_y, color='gray', linestyle='dashed', label='Goal Area')

    # Hide axis labels and ticks
    ax.set_xticks([])
    ax.set_yticks([])
    ax.set_xticklabels([])
    ax.set_yticklabels([])
    ax.set_title('Girona Shoots')

    # Add legend for shot types
    legend_elements = [plt.Line2D([0], [0], marker='o', color='w', label=shot_type, markerf
    ax.legend(handles=legend_elements, loc='upper right', title='Shot Type')

    # Show the plot
    plt.show()

# Call the function with your shotmap data
plot_goal_shots_and_area(shots)
```



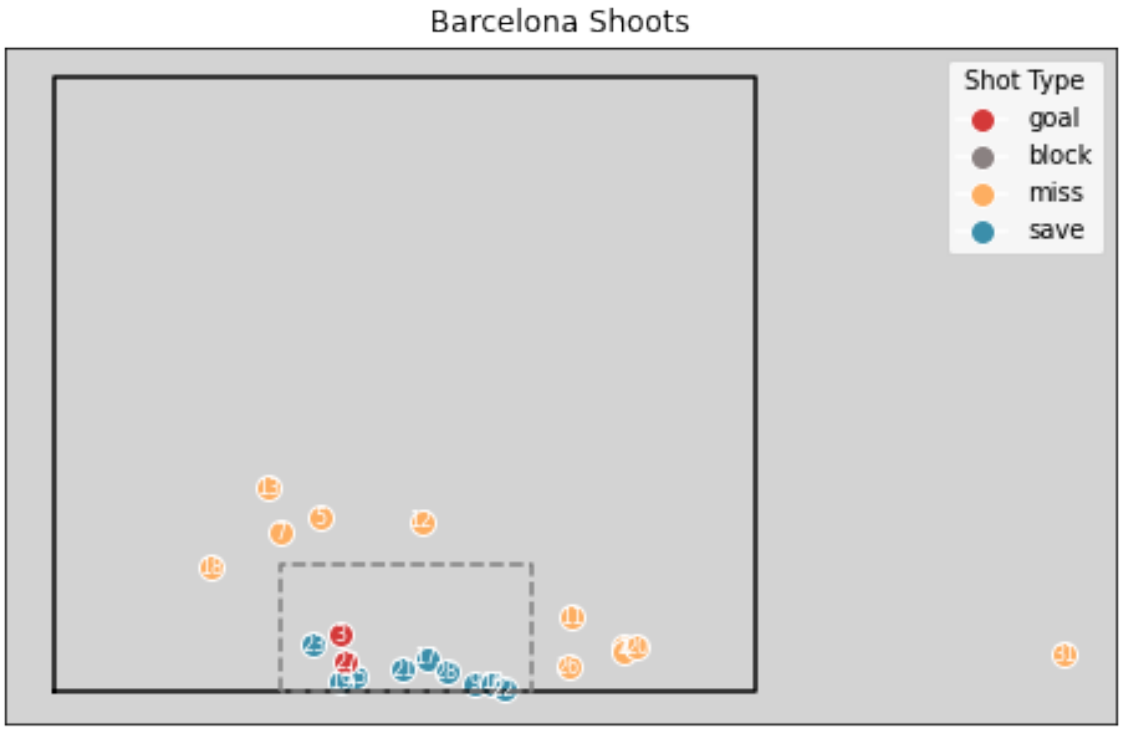

```
# Extract shot data for Girona
barcelona_shots = shotmap_data['shotmap']

# Create an mplsoccer Pitch
pitch = VerticalPitch(pitch_type='opta', pitch_color='#22312b', half=True)

# Plot the shots on the pitch
fig, ax = pitch.draw(figsize=(12, 10))

# Dictionary to map shot types to colors
shot_type_colors = {
    'goal': '#d43939',
    'block': '#8a8181',
    'miss': '#fdae61',
    'save': '#3b8eaa'
}

# Separate goal and non-goal shots for Girona at away games
barcelona_goal_shots = [shot for shot in barcelona_shots if shot['isHome'] == True]

# Plot non-goal shots with hatch
for i, shot in enumerate(barcelona_goal_shots):
    x = 100 - shot['playerCoordinates']['y']
```

```
    y = 100 - shot['playerCoordinates']['x']
    xg = shot['xg']
    shot_type = shot['shotType']

    color = shot_type_colors.get(shot_type)

    ax.scatter(x, y, s=(xg * 1900) + 100, edgecolors='white', c=color, marker='o')
    ax.text(x, y, s=str(i+1), color='white', ha='center', va='center', fontsize=8)

# Add title
txt = ax.text(x=50, y=60, s='Barcelona Shots', size=30, color=pitch.line_color, va='center'

# Add legend for shot types
legend_elements = [plt.Line2D([0], [0], marker='o', color='w', label=shot_type, markerfacec
ax.legend(handles=legend_elements, loc='upper right', title='Shot Type')


plt.show()
```



```
# Create a function to plot the football goal, shots, and goal area
def plot_goal_shots_and_area(shotmap_data):

    # Create a football goal plot
    fig, ax = plt.subplots(figsize=(8, 5))
    ax.set_facecolor('lightgrey')  # Set background color
    ax.plot([-20, -20, 120, 120, -20], [0, 120, 120, 0, 0], color='black')  # Football goal

    girona_shots = [shot for shot in shotmap_data if shot['isHome'] == True]


    # Scatter shots on the goal for non-home shots
    for i, shot in enumerate(girona_shots):
        if shot['shotType'] != 'block':
            goal_coordinates = shot['draw']['goal']
            shot_type = shot['shotType']
            color = shot_type_colors.get(shot_type)
            if (50 - goal_coordinates['x']) >= 0:
                ax.scatter(50 - ((50 - goal_coordinates['x'])*5), (100 - goal_coordinates['
                ax.text(50 - ((50 - goal_coordinates['x'])*5), (100 - goal_coordinates['y']
            else:
                ax.scatter(50 + (abs((50 - goal_coordinates['x']))*5), (100 - goal_coordina
                ax.text(50 + (abs((50 - goal_coordinates['x']))*5), (100 - goal_coordinates

    # Draw the football goal area
    goal_area_x = [25, 25, 75, 75, 25]
    goal_area_y = [0, 25, 25, 0, 0]
    ax.plot(goal_area_x, goal_area_y, color='gray', linestyle='dashed', label='Goal Area')

    # Hide axis labels and ticks
    ax.set_xticks([])
    ax.set_yticks([])
    ax.set_xticklabels([])
    ax.set_yticklabels([])
    ax.set_title('Barcelona Shoots')

    # Add legend for shot types
    legend_elements = [plt.Line2D([0], [0], marker='o', color='w', label=shot_type, markerf
    ax.legend(handles=legend_elements, loc='upper right', title='Shot Type')

    # Show the plot
    plt.show()

# Call the function with your shotmap data
```

```
plot_goal_shots_and_area(shots)
```



Passes Flow

```
import json

import numpy as np
import pandas as pd
from matplotlib import rcParams
import matplotlib.pyplot as plt
from matplotlib.colors import LinearSegmentedColormap

from mplsoccer import Pitch, FontManager, Sbopen

with open("./data/WhoScored/match_1734731.json") as f:
    data_dict = json.load(f)
#data_dict.keys()
```

```
def extract_data_from_dict(data):
    # load data from json
```

```
    event_types_json = data["matchCentreEventTypeJson"]
    formation_mappings = data["formationIdNameMappings"]
    events_dict = data["matchCentreData"]["events"]
    teams_dict = {data["matchCentreData"]['home']['teamId']: data["matchCentreData"]['home'
                  data["matchCentreData"]['away']['teamId']: data["matchCentreData"]['away'
    players_dict = data["matchCentreData"]["playerIdNameDictionary"]
    # create players dataframe
    players_home_df = pd.DataFrame(data["matchCentreData"]['home']['players'])
    players_home_df["teamId"] = data["matchCentreData"]['home']['teamId']
    players_away_df = pd.DataFrame(data["matchCentreData"]['away']['players'])
    players_away_df["teamId"] = data["matchCentreData"]['away']['teamId']
    players_df = pd.concat([players_home_df, players_away_df])
    players_ids = data["matchCentreData"]["playerIdNameDictionary"]
    return events_dict, players_df, teams_dict
```

```
events_dict, players_df, teams_dict = extract_data_from_dict(data_dict)
home_team_id = 2783
away_team_id = 65
```

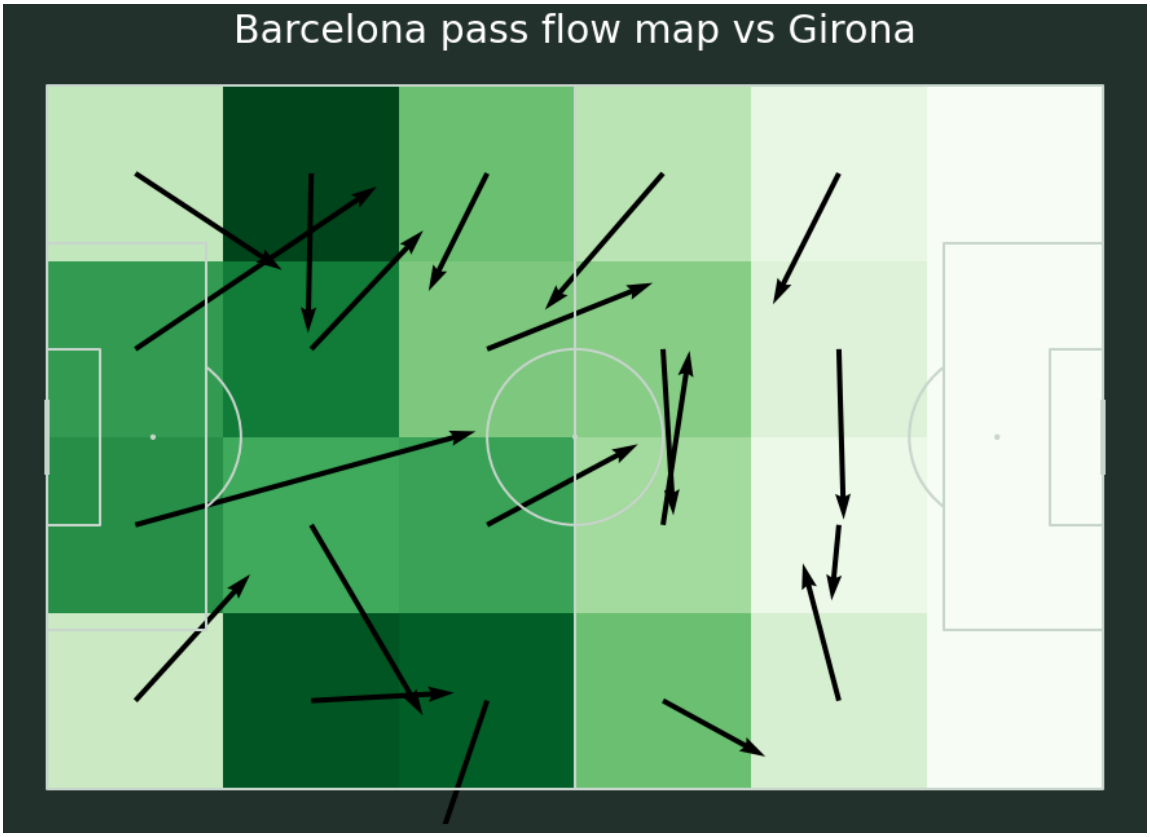
```
def get_passes_df(events_dict, team_id):
    df = pd.DataFrame(events_dict)
    df['eventType'] = df.apply(lambda row: row['type']['displayName'], axis=1)
    df['outcomeType'] = df.apply(lambda row: row['outcomeType']['displayName'], axis=1)


    # filter only passes and team
    passes_ids = df.index[(df['eventType'] == 'Pass') & (df['teamId'] == team_id)]
    df_passes = df.loc[
        passes_ids, ["id", "x", "y", "endX", "endY", "teamId", "playerId", "eventType", "ou

    return df_passes
```

```
home_team_df_pass = get_passes_df(events_dict, home_team_id)
# home_team_df_pass
```

```
# away_team_df_pass
away_team_df_pass = get_passes_df(events_dict, away_team_id)
```

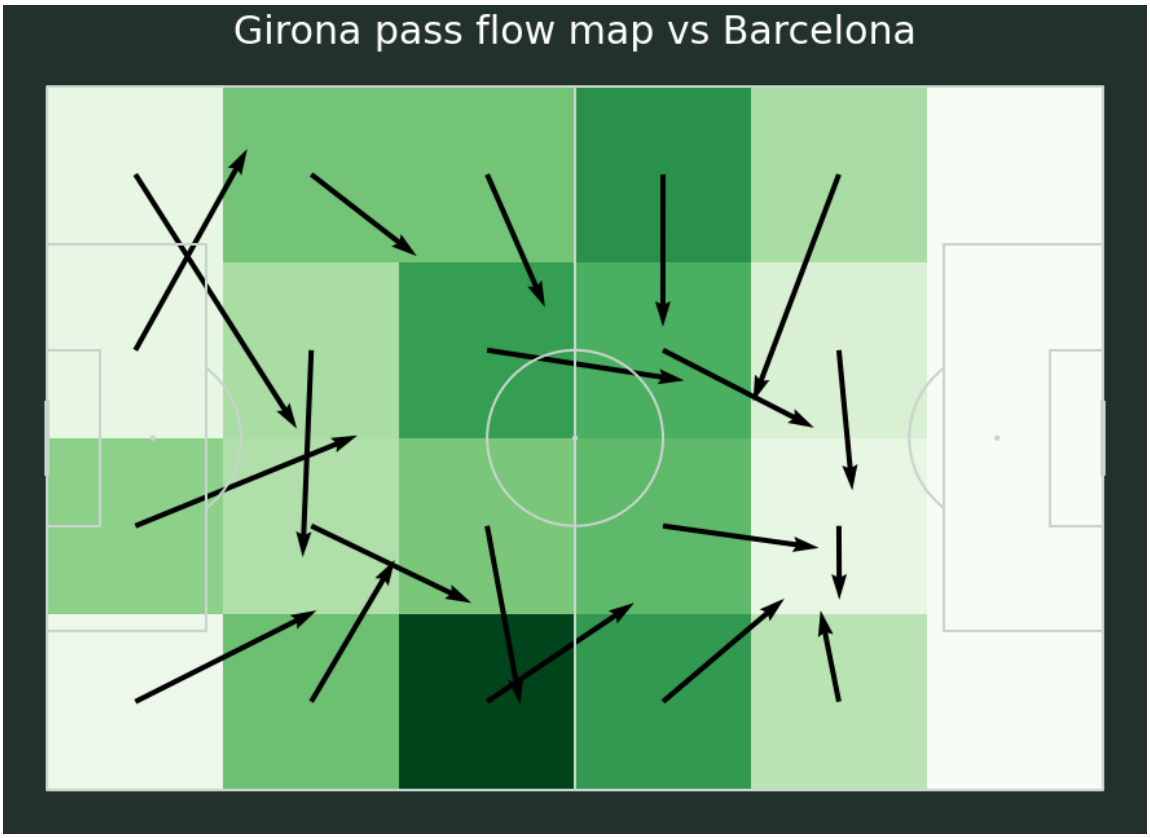
```
pitch = Pitch(pitch_type='statsbomb',  line_zorder=2, line_color='#c7d5cc', pitch_color='#2
bins = (6, 4)
```

```
# Barcelona
fig, ax = pitch.draw(figsize=(16, 11), constrained_layout=True, tight_layout=False)
fig.set_facecolor('#22312b')
# plot the heatmap - darker colors = more passes originating from that square
bs_heatmap = pitch.bin_statistic(home_team_df_pass.x, home_team_df_pass.y, statistic='count
hm = pitch.heatmap(bs_heatmap, ax=ax, cmap='Greens')
# plot the pass flow map with a single color and the
# arrow length equal to the average distance in the cell
fm = pitch.flow(home_team_df_pass.x, home_team_df_pass.y, home_team_df_pass.endX, home_team
                arrow_type='average', bins=bins, ax=ax)
ax_title = ax.set_title(f'Barcelona pass flow map vs Girona', fontsize=30, pad=-20, color =
```




```
#Girona
fig, ax = pitch.draw(figsize=(16, 11), constrained_layout=True, tight_layout=False)
fig.set_facecolor('#22312b')
# plot the heatmap - darker colors = more passes originating from that square
bs_heatmap = pitch.bin_statistic(away_team_df_pass.x, away_team_df_pass.y, statistic='count
hm = pitch.heatmap(bs_heatmap, ax=ax, cmap='Greens')
# plot the pass flow map with a single color and the
# arrow length equal to the average distance in the cell
```

```
fm = pitch.flow(away_team_df_pass.x, away_team_df_pass.y, away_team_df_pass.endX, away_team
                arrow_type='average', bins=bins, ax=ax)
ax_title = ax.set_title(f'Girona pass flow map vs Barcelona', fontsize=30, pad=-20, color =
```



Passes Networks

```
import json
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.font_manager import FontManager
from matplotlib.colors import to_rgba
from mplsoccer import Pitch

with open("./data/WhoScored/match_1734731.json") as f:
    data_dict = json.load(f)
#data_dict.keys()
```

```
def extract_data_from_dict(data):
    # load data from json
    event_types_json = data["matchCentreEventTypeJson"]
    formation_mappings = data["formationIdNameMappings"]
    events_dict = data["matchCentreData"]["events"]
    teams_dict = {data["matchCentreData"]['home']['teamId']: data["matchCentreData"]['home'
                  data["matchCentreData"]['away']['teamId']: data["matchCentreData"]['away'
    players_dict = data["matchCentreData"]["playerIdNameDictionary"]
    # create players dataframe
    players_home_df = pd.DataFrame(data["matchCentreData"]['home']['players'])
    players_home_df["teamId"] = data["matchCentreData"]['home']['teamId']
    players_away_df = pd.DataFrame(data["matchCentreData"]['away']['players'])
    players_away_df["teamId"] = data["matchCentreData"]['away']['teamId']
    players_df = pd.concat([players_home_df, players_away_df])
    players_ids = data["matchCentreData"]["playerIdNameDictionary"]
    return events_dict, players_df, teams_dict
```

```
events_dict, players_df, teams_dict = extract_data_from_dict(data_dict)
len(events_dict)
teams_dict
home_team_id = 2783
away_team_id = 65
# home_team_id, away_team_id
```

```
def get_passes_df(events_dict):
    df = pd.DataFrame(events_dict)
    df['eventType'] = df.apply(lambda row: row['type']['displayName'], axis=1)
    df['outcomeType'] = df.apply(lambda row: row['outcomeType']['displayName'], axis=1)

    # create receiver column based on the next event
    # this will be correct only for successfull passes
    df["receiver"] = df["playerId"].shift(-1)

    # filter only passes
    passes_ids = df.index[df['eventType'] == 'Pass']
    df_passes = df.loc[
        passes_ids, ["id", "x", "y", "endX", "endY", "teamId", "playerId", "receiver", "eve

    return df_passes
```

```
passes_df = get_passes_df(events_dict)
#passes_df
```

```
def get_passes_between_df(team_id, passes_df, players_df):
    # filter for only team
    print(team_id)
    passes_df = passes_df[passes_df["teamId"] == team_id]

    # add column with first eleven players only
    passes_df = passes_df.merge(players_df[["playerId", "isFirstEleven"]], on='playerId', h
    # filter on first eleven column
    passes_df = passes_df[passes_df['isFirstEleven'] == True]

    # calculate mean positions for players
    average_locs_and_count_df = (passes_df.groupby('playerId')
                                 .agg({'x': ['mean'], 'y': ['mean', 'count']}))
    average_locs_and_count_df.columns = ['x', 'y', 'count']
    average_locs_and_count_df = average_locs_and_count_df.merge(players_df[['playerId', 'na
                                                                on='playerId', how='left')
    average_locs_and_count_df = average_locs_and_count_df.set_index('playerId')
    # print(average_locs_and_count_df)

    # calculate the number of passes between each position (using min/ max so we get passes
    passes_player_ids_df = passes_df.loc[:, ['id', 'playerId', 'receiver', 'teamId']]
    passes_player_ids_df['pos_max'] = (passes_player_ids_df[['playerId', 'receiver']].max(a
    passes_player_ids_df['pos_min'] = (passes_player_ids_df[['playerId', 'receiver']].min(a

    # get passes between each player
    passes_between_df = passes_player_ids_df.groupby(['pos_min', 'pos_max']).id.count().res
    passes_between_df.rename({'id': 'pass_count'}, axis='columns', inplace=True)

    # add on the location of each player so we have the start and end positions of the line
    passes_between_df = passes_between_df.merge(average_locs_and_count_df, left_on='pos_min
    passes_between_df = passes_between_df.merge(average_locs_and_count_df, left_on='pos_max
                                                suffixes=['', '_end'])
    return passes_between_df, average_locs_and_count_df
```

```
#home_passes_between_df, home_average_locs_and_count_df = get_passes_between_df(team_id=hom
#home_passes_between_df
```

```
#away_passes_between_df, away_average_locs_and_count_df = get_passes_between_df(team_id=awa
#away_passes_between_df
```

```
def pass_network_visualization(ax, passes_between_df, average_locs_and_count_df, flipped=Fa
    MAX_LINE_WIDTH = 10
    MAX_MARKER_SIZE = 3000
    passes_between_df['width'] = (passes_between_df.pass_count / passes_between_df.pass_cou
```

```
                                    MAX_LINE_WIDTH)
    average_locs_and_count_df['marker_size'] = (average_locs_and_count_df['count']
                                                / average_locs_and_count_df['count'].max()

    MIN_TRANSPARENCY = 0.3
    color = np.array(to_rgba('#507293'))
    color = np.tile(color, (len(passes_between_df), 1))
    c_transparency = passes_between_df.pass_count / passes_between_df.pass_count.max()
    c_transparency = (c_transparency * (1 - MIN_TRANSPARENCY)) + MIN_TRANSPARENCY
    color[:, 3] = c_transparency

    pitch = Pitch(pitch_type='opta', pitch_color='#0D182E', line_color='#5B6378')
    pitch.draw(ax=ax)

    if flipped:
        passes_between_df['x'] = pitch.dim.right - passes_between_df['x']
        passes_between_df['y'] = pitch.dim.right - passes_between_df['y']
        passes_between_df['x_end'] = pitch.dim.right - passes_between_df['x_end']
        passes_between_df['y_end'] = pitch.dim.right - passes_between_df['y_end']
        average_locs_and_count_df['x'] = pitch.dim.right - average_locs_and_count_df['x']
        average_locs_and_count_df['y'] = pitch.dim.right - average_locs_and_count_df['y']

    pass_lines = pitch.lines(passes_between_df.x, passes_between_df.y,
                             passes_between_df.x_end, passes_between_df.y_end, lw=passes_be
                             color=color, zorder=1, ax=ax)
    pass_nodes = pitch.scatter(average_locs_and_count_df.x, average_locs_and_count_df.y,
                               s=average_locs_and_count_df.marker_size, marker='h',
                               color='#FEFEFC', edgecolors='#FEFEFC', linewidth=1, alpha=1,
    for index, row in average_locs_and_count_df.iterrows():
        print(row)
        player_name = row["name"].split()
        player_initials = "".join(word[0] for word in player_name).upper()
        pitch.annotate(player_initials, xy=(row.x, row.y), c='#C4C4C4', va='center',
                       ha='center', size=14, ax=ax)

    return pitch
```

```
# create plot
fig, axes = plt.subplots(1, 2, figsize=(15, 8))
plt.subplots_adjust(left=None, bottom=None, right=None, top=None, wspace=None, hspace=None)
axes = axes.flat
plt.tight_layout()
fig.set_facecolor("#0D182E")
```

```
# plot variables
main_color = '#FBFAF5'
font_bold = FontManager(("https://github.com/google/fonts/blob/main/apache/roboto/static/"
                         "RobotoCondensed-Medium.ttf?raw=true"))

# home team viz
pass_network_visualization(axes[0], home_passes_between_df, home_average_locs_and_count_df)
axes[0].set_title(teams_dict[home_team_id], color=main_color, fontsize=14)#, fontproperties

# away team viz
pass_network_visualization(axes[1], away_passes_between_df, away_average_locs_and_count_df,
axes[1].set_title(teams_dict[away_team_id], color=main_color, fontsize=14)#, fontproperties

plt.suptitle(f"{teams_dict[home_team_id]} - {teams_dict[away_team_id]}", color=main_color,
subtitle = "Passing networks and top combinations by volume of passes"
plt.text(-10, 120, subtitle, horizontalalignment='center', verticalalignment='center', colo
plt.show()
```

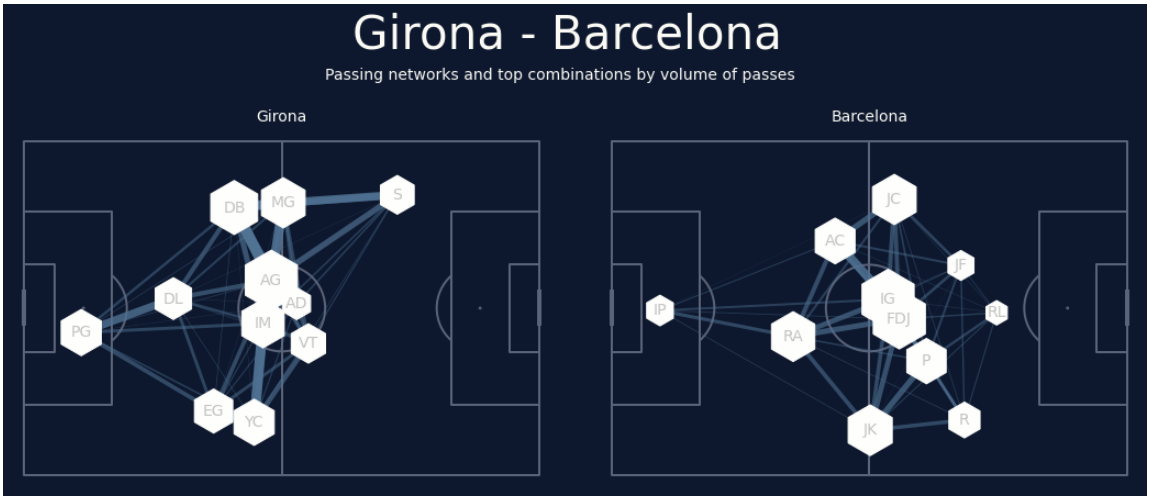
```
x                  40.765
y                80.163333
count                   60
name           Daley Blind
shirtNo                 17
position                DC
marker_size    2432.432432
Name: 70033.0, dtype: object
x                    28.95
y                 52.847222
count                   36
name           David López
shirtNo                  5
position                DC
marker_size    1459.459459
Name: 92691.0, dtype: object
x                 11.065909
y                 42.654545
count                    44
name           Paulo Gazzaniga
shirtNo                  13
position                 GK
marker_size        1783.783784
Name: 104732.0, dtype: object
x                   55.165625
y                   39.390625
```

```
count                        32
name            Viktor Tsygankov
shirtNo                       8
position                    AMC
marker_size          1297.297297
Name: 231125.0, dtype: object
x                     47.972973
y                     58.371622
count                        74
name              Aleix García
shirtNo                      14
position                     MC
marker_size              3000.0
Name: 280663.0, dtype: object
x                     52.895238
y                     51.328571
count                        21
name             Artem Dovbyk
shirtNo                       9
position                     FW
marker_size          851.351351
Name: 296975.0, dtype: object
x                      36.7675
y                       19.115
count                       40
name              Eric García
shirtNo                     25
position                    DC
marker_size       1621.621622
Name: 368091.0, dtype: object
x                     46.355102
y                     45.373469
count                        49
name             Iván Martín
shirtNo                     23
position                    MC
marker_size       1986.486486
Name: 372473.0, dtype: object
x                     50.288462
y                        81.575
count                        52
name           Miguel Gutiérrez
shirtNo                       3
position                    DML
marker_size          2108.108108
```

```
Name: 395788.0, dtype: object
x                72.429032
y                83.970968
count                   31
name                 Sávio
shirtNo                 16
position               AMC
marker_size    1256.756757
Name: 397821.0, dtype: object
x                44.634091
y                15.740909
count                   44
name              Yan Couto
shirtNo                 20
position               DMR
marker_size    1783.783784
Name: 421975.0, dtype: object
x                       74.728571
y                       48.585714
count                          14
name           Robert Lewandowski
shirtNo                         9
position                       FW
marker_size                 500.0
Name: 29400.0, dtype: object
x                       53.65
y                   52.645238
count                      84
name           Ilkay Gündogan
shirtNo                    22
position                   MC
marker_size            3000.0
Name: 77464.0, dtype: object
x                  54.862712
y                  82.579661
count                     59
name           João Cancelo
shirtNo                    2
position                  DL
marker_size     2107.142857
Name: 128967.0, dtype: object
x                       43.371429
y                       70.136735
count                          49
name           Andreas Christensen
```

```
shirtNo                         15
position                        DC
marker_size                 1750.0
Name: 130331.0, dtype: object
x                       55.828571
y                       46.734524
count                          84
name              Frenkie de Jong
shirtNo                        21
position                       MC
marker_size                3000.0
Name: 279423.0, dtype: object
x                    68.476667
y                        16.43
count                       30
name                  Raphinha
shirtNo                     11
position                   FWR
marker_size        1071.428571
Name: 300447.0, dtype: object
x                     50.176667
y                     13.346667
count                        60
name              Jules Koundé
shirtNo                      23
position                     DR
marker_size         2142.857143
Name: 301019.0, dtype: object
x                    67.795238
y                    62.785714
count                       21
name              João Félix
shirtNo                     14
position                  FWL
marker_size             750.0
Name: 362431.0, dtype: object
x                     9.368182
y                    49.268182
count                       22
name              Iñaki Peña
shirtNo                     13
position                    GK
marker_size        785.714286
Name: 367164.0, dtype: object
x                       35.22069
```

```
y                       41.45
count                      58
name           Ronald Araújo
shirtNo                     4
position                   DC
marker_size       2071.428571
Name: 384711.0, dtype: object
x                  61.102083
y                  34.091667
count                     48
name                   Pedri
shirtNo                    8
position                  MC
marker_size      1714.285714
Name: 402197.0, dtype: object
```



Cumulative xG

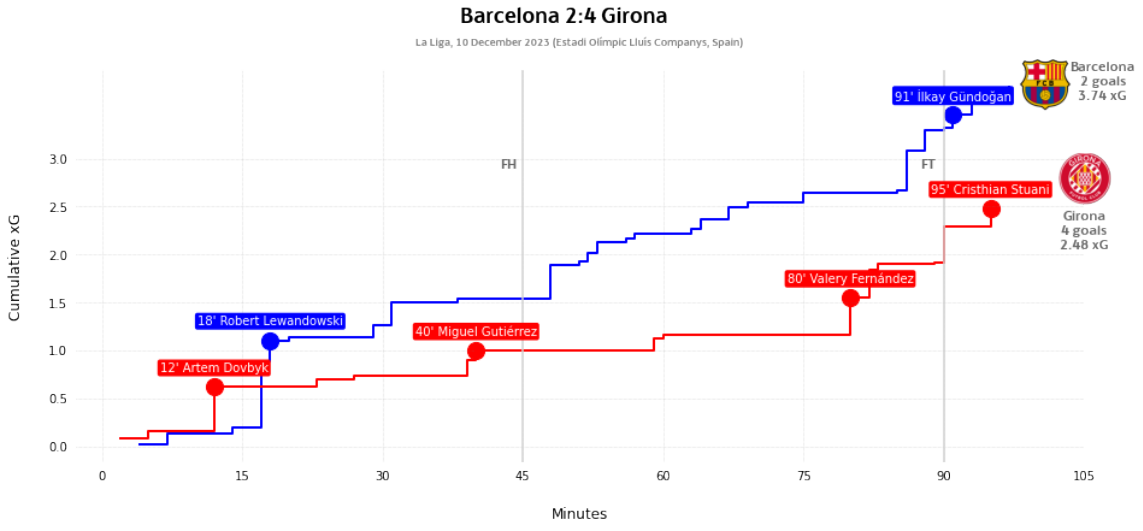
```
import json
import pandas as pd
import numpy as np
import matplotlib as mpl
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from matplotlib.lines import Line2D
from matplotlib import font_manager

with open('./data/sofascore/shots.json') as f:
```

```
    shotmap = json.load(f)

shots = pd.json_normalize(shotmap["shotmap"])
#shots

# Barcelona cumulative xG
home_xg_cum = shots[shots["isHome"] == True][["isHome", "shotType", "xg", "timeSeconds", "p
home_xg_cum["minute"] = round(home_xg_cum["timeSeconds"]/60).astype(int)
home_xg_cum.sort_values(by="minute", inplace=True)
home_xg_cum["xg_cum"] = home_xg_cum["xg"].cumsum()

# Girona cumulative xG
away_xg_cum = shots[shots["isHome"] == False][["isHome", "shotType", "xg", "timeSeconds", "
away_xg_cum["minute"] = round(away_xg_cum["timeSeconds"]/60).astype(int)
away_xg_cum.sort_values(by="minute", inplace=True)
away_xg_cum["xg_cum"] = away_xg_cum["xg"].cumsum()
#away_xg_cum

home_goals = home_xg_cum[home_xg_cum["shotType"] == "goal"][["isHome", "minute", "player.na
home_goals["scorechart"] = home_goals["minute"].astype(str) + "'" + " " + home_goals["playe
home_goal_count = len(home_goals)

away_goals = away_xg_cum[away_xg_cum["shotType"] == "goal"][["isHome", "minute", "player.na
away_goals["scorechart"] = away_goals["minute"].astype(int).astype(str) + "'" + " " + away_
away_goal_count = len(away_goals)
#away_goals

home_xg_total = round(home_xg_cum["xg"].sum(), 2).astype(str)
away_xg_total = round(away_xg_cum["xg"].sum(), 2).astype(str)
```

```
def set_plot_title(suptitle, title):
    plt.suptitle(suptitle, fontsize=20, fontproperties=font_properties, y=1)
    plt.title(title, fontsize=14, fontproperties=font_properties, color="gray", pad=20)

def annotate_goals(goals):
    for i, row in goals.iterrows():
        facecolor = "blue" if row["isHome"] else "red"

        plt.text(
            row["minute"],
            row["xg_cum"] + 0.2,
            row["scorechart"],
            ha="center",
            va="center",
```

```
            fontsize=10,
            color="white",
            bbox=dict(
                facecolor=facecolor,
                edgecolor="None",
                boxstyle="round,pad=0.2"
            )
        )

fig, ax = plt.subplots(figsize=(15,6))

font_properties = font_manager.FontProperties(fname="./fonts/Champions-Bold.ttf")

set_plot_title(
    suptitle="Barcelona 2:4 Girona",
    title="La Liga, 10 December 2023 (Estadi Olímpic Lluís Companys, Spain)"
)

ax.spines["top"].set_visible(False)
ax.spines["right"].set_visible(False)
ax.spines["bottom"].set_visible(False)
ax.spines["left"].set_visible(False)

ax.step(x=home_xg_cum["minute"], y=home_xg_cum["xg_cum"], where="post", color="blue", label
ax.step(x=away_xg_cum["minute"], y=away_xg_cum["xg_cum"], where="post", color="red", label=

ax.scatter(x=home_goals["minute"], y=home_goals["xg_cum"], marker="o", s=200, color="blue")
ax.scatter(x=away_goals["minute"], y=away_goals["xg_cum"], marker="o", s=200, color="red")

plt.xticks([0, 15, 30, 45, 60, 75, 90, 105])
plt.yticks([0, 0.5, 1, 1.5, 2, 2.5, 3])

ax.tick_params(axis="both", which="both", bottom=False, top=False, left=False, right=False)
ax.grid(True, linestyle="dotted", alpha=0.5, color="gray", linewidth=0.5)

ax.axvline(x=45, color="lightgray")
ax.axvline(x=90, color="lightgray")
plt.text(42.5, 2.9, "FH", color="dimgray", fontsize=13, fontproperties=font_properties)
plt.text(87.5, 2.9, "FT", color="dimgray", fontsize=13, fontproperties=font_properties)

annotate_goals(home_goals)
annotate_goals(away_goals)

stat_text_options = dict(ha="center", va="center", color="dimgray", fontsize=13, fontproper
```

```
plt.text(107, 3.95, "Barcelona", **stat_text_options)
plt.text(107, 3.8, f"{home_goal_count} goals", **stat_text_options)
plt.text(107, 3.65, f"{home_xg_total} xG", **stat_text_options)

plt.text(105, 2.4, "Girona", **stat_text_options)
plt.text(105, 2.25, f"{away_goal_count} goals", **stat_text_options)
plt.text(105, 2.1, f"{away_xg_total} xG", **stat_text_options)

plt.ylabel("Cumulative xG", fontsize=12, labelpad=20)
plt.xlabel("Minutes", fontsize=12, labelpad=20)

home_logo = mpimg.imread("./img/Barcelona.png")
ax_home_logo = fig.add_axes([0.82, 0.8, 0.1, 0.1])
ax_home_logo.imshow(home_logo)
ax_home_logo.axis("off")

away_logo = mpimg.imread("./img/Girona.png")
ax_away_logo = fig.add_axes([0.85, 0.62, 0.1, 0.1])
ax_away_logo.imshow(away_logo)
ax_away_logo.axis("off")

plt.savefig("./img/Cumulative_xg.png", dpi=300, bbox_inches="tight")

plt.show()
```



Radar chart

```
import pandas as pd
from scipy import stats
import sklearn
df_understat = pd.read_json('./data/under_shot_data.json')
df_sofascore = pd.read_json('./data/sofa_shot_data.json')

def data_scale(data, scaler_type='minmax'):
    from sklearn.preprocessing import MinMaxScaler
    from sklearn.preprocessing import StandardScaler
    from sklearn.preprocessing import Normalizer
    if scaler_type == 'minmax':
        scaler = MinMaxScaler()
    if scaler_type == 'std':
        scaler = StandardScaler()
    if scaler_type == 'norm':
        scaler = preprocessing.Normalizer()

    scaler.fit(data)
    res = scaler.transform(data)
    return res
```

```
df_understat.info()
print(df_understat.head())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 46 entries, 0 to 45
Data columns (total 20 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   id               46 non-null     int64
 1   minute           46 non-null     int64
 2   result           46 non-null     object
 3   X                46 non-null     float64
 4   Y                46 non-null     float64
 5   xG               46 non-null     float64
 6   player           46 non-null     object
 7   h_a              46 non-null     object
 8   player_id        46 non-null     int64
 9   situation        46 non-null     object
 10  season           46 non-null     int64
 11  shotType         46 non-null     object
```

```
 12  match_id         46 non-null     int64
 13  h_team           46 non-null     object
 14  a_team           46 non-null     object
 15  h_goals          46 non-null     int64
 16  a_goals          46 non-null     int64
 17  date             46 non-null     datetime64[ns]
 18  player_assisted  41 non-null     object
 19  lastAction       46 non-null     object
dtypes: datetime64[ns](1), float64(3), int64(7), object(9)
memory usage: 7.3+ KB
       id  minute       result      X      Y        xG              player  \
0  553813       4  MissedShots  0.920  0.624  0.027585           Raphinha
1  553815       6  BlockedShot  0.954  0.412  0.135576  Robert Lewandowski
2  553817      14  BlockedShot  0.872  0.391  0.076541         João Félix
3  553818      17    SavedShot  0.969  0.488  0.654123           Raphinha
4  553819      18         Goal  0.932  0.514  0.126038  Robert Lewandowski

  h_a  player_id   situation  season   shotType  match_id     h_team  a_team  \
0   h       8026  FromCorner    2023       Head     22835  Barcelona  Girona
1   h        227    OpenPlay    2023  RightFoot     22835  Barcelona  Girona
2   h       7892    OpenPlay    2023  RightFoot     22835  Barcelona  Girona
3   h       8026    OpenPlay    2023   LeftFoot     22835  Barcelona  Girona
4   h        227  FromCorner    2023       Head     22835  Barcelona  Girona

   h_goals  a_goals                date player_assisted lastAction
0        2        4 2023-12-10 20:00:00  Ilkay Gündogan      Cross
1        2        4 2023-12-10 20:00:00           Pedri       Pass
2        2        4 2023-12-10 20:00:00           Pedri       Pass
3        2        4 2023-12-10 20:00:00    João Cancelo      Cross
4        2        4 2023-12-10 20:00:00        Raphinha      Cross
```

```
data_understat = df_understat[['player', 'X', 'Y', 'xG']]
print(data_understat)
```

```
                player      X      Y        xG
0             Raphinha  0.920  0.624  0.027585
1   Robert Lewandowski  0.954  0.412  0.135576
2           João Félix  0.872  0.391  0.076541
3             Raphinha  0.969  0.488  0.654123
4   Robert Lewandowski  0.932  0.514  0.126038
5             Raphinha  0.864  0.305  0.040520
6           João Félix  0.872  0.596  0.085429
7       Ilkay Gündogan  0.834  0.594  0.055819
8         João Cancelo  0.964  0.601  0.434831
```

```
9             Raphinha  0.734  0.540  0.021653
10  Robert Lewandowski  0.952  0.568  0.386009
11            Raphinha  0.927  0.606  0.045518
12    Frenkie de Jong   0.756  0.421  0.024202
13            Raphinha  0.812  0.641  0.110629
14            Raphinha  0.912  0.521  0.101295
15     Ilkay Gündogan   0.741  0.579  0.020296
16            Raphinha  0.834  0.368  0.045099
17     Ilkay Gündogan   0.783  0.557  0.031369
18  Robert Lewandowski  0.943  0.554  0.122883
19     Ilkay Gündogan   0.909  0.812  0.072592
20     Ilkay Gündogan   0.890  0.575  0.098598
21  Robert Lewandowski  0.840  0.515  0.070940
22     Ilkay Gündogan   0.820  0.461  0.061176
23       Jules Koundé   0.782  0.301  0.015336
24     Ilkay Gündogan   0.958  0.532  0.603760
25       Fermín López   0.916  0.502  0.131917
26       Fermín López   0.905  0.517  0.076984
27      Ferrán Torres   0.728  0.590  0.013073
28     Ilkay Gündogan   0.909  0.458  0.103959
29  Robert Lewandowski  0.923  0.521  0.354385
30       Fermín López   0.857  0.382  0.106343
31        David López   0.911  0.556  0.092746
32   Viktor Tsygankov   0.786  0.681  0.024357
33       Artem Dovbyk   0.923  0.545  0.520011
34       Artem Dovbyk   0.902  0.580  0.056151
35   Miguel Gutiérrez   0.925  0.683  0.062417
36   Miguel Gutiérrez   0.898  0.625  0.094226
37   Miguel Gutiérrez   0.854  0.632  0.061740
38   Viktor Tsygankov   0.910  0.517  0.120849
39          Yan Couto   0.868  0.305  0.049720
40   Valery Fernández   0.845  0.504  0.315130
41              Sávio   0.903  0.683  0.400269
42   Cristhian Stuani   0.921  0.390  0.039501
43         Jhon Solis   0.734  0.638  0.015792
44         Jhon Solis   0.930  0.473  0.614128
45   Cristhian Stuani   0.984  0.433  0.470938
```

```
df_sofascore.info()
print(df_sofascore.head())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 46 entries, 0 to 45
Data columns (total 20 columns):
```

```
 #   Column                     Non-Null Count  Dtype
---  ------                     --------------  -----
 0   player                     46 non-null     object
 1   isHome                     46 non-null     bool
 2   shotType                   46 non-null     object
 3   situation                  46 non-null     object
 4   playerCoordinates          46 non-null     object
 5   bodyPart                   46 non-null     object
 6   goalMouthLocation          46 non-null     object
 7   goalMouthCoordinates       46 non-null     object
 8   blockCoordinates           24 non-null     object
 9   xg                         46 non-null     float64
 10  id                         46 non-null     int64
 11  time                       46 non-null     int64
 12  addedTime                  7 non-null      float64
 13  timeSeconds                46 non-null     int64
 14  draw                       46 non-null     object
 15  reversedPeriodTime         46 non-null     int64
 16  reversedPeriodTimeSeconds  46 non-null     int64
 17  incidentType               46 non-null     object
 18  goalType                   6 non-null      object
 19  xgot                       18 non-null     float64
dtypes: bool(1), float64(3), int64(5), object(11)
memory usage: 7.0+ KB
                                               player  isHome shotType  \
0  {'name': 'Fermín López', 'firstName': 'Fermín ...    True    block
1  {'name': 'Cristhian Stuani', 'slug': 'cristhia...   False     goal
2  {'name': 'Robert Lewandowski', 'firstName': ''...    True     miss
3  {'name': 'İlkay Gündoğan', 'slug': 'ilkay-gund...    True     goal
4  {'name': 'Ferran Torres', 'slug': 'ferran-torr...    True     miss

  situation              playerCoordinates    bodyPart goalMouthLocation  \
0   regular  {'x': 12.9, 'y': 62.2, 'z': 0}  right-foot        low-centre
1  assisted   {'x': 2.6, 'y': 57.3, 'z': 0}  right-foot         low-right
2  assisted   {'x': 7.7, 'y': 47.9, 'z': 0}        head       close-right
3  assisted   {'x': 9.1, 'y': 54.2, 'z': 0}   left-foot          low-left
4  assisted  {'x': 24.8, 'y': 41.9, 'z': 0}  right-foot       close-right

            goalMouthCoordinates                blockCoordinates        xg  \
0    {'x': 0, 'y': 51.2, 'z': 19}  {'x': 10.7, 'y': 59.9, 'z': 0}  0.089518
1    {'x': 0, 'y': 46, 'z': 11.4}                             NaN  0.186681
2  {'x': 0, 'y': 41.3, 'z': 15.3}                             NaN  0.195696
3    {'x': 0, 'y': 52.6, 'z': 19}                             NaN  0.134803
4  {'x': 0, 'y': 41.3, 'z': 13.9}                             NaN  0.024742
```

```
        id  time  addedTime  timeSeconds  \
0  2396401    90        7.0         5791
1  2396400    90        5.0         5674
2  2396398    90        3.0         5557
3  2396394    90        2.0         5474
4  2396393    90        1.0         5415

                                                draw  reversedPeriodTime  \
0  {'start': {'x': 62.2, 'y': 12.9}, 'block': {'x...                    1
1  {'start': {'x': 57.3, 'y': 2.6}, 'end': {'x': ...                    1
2  {'start': {'x': 47.9, 'y': 7.7}, 'end': {'x': ...                    1
3  {'start': {'x': 54.2, 'y': 9.1}, 'end': {'x': ...                    1
4  {'start': {'x': 41.9, 'y': 24.8}, 'end': {'x':...                    1

   reversedPeriodTimeSeconds incidentType goalType    xgot
0                        509         shot      NaN     NaN
1                        626         shot  regular  0.7595
2                        743         shot      NaN     NaN
3                        826         shot  regular  0.2616
4                        885         shot      NaN     NaN
```

```
data_sofascore = df_sofascore[['player', 'playerCoordinates', 'xg']]
print(data_sofascore.head())
```

```
                                              player  \
0  {'name': 'Fermín López', 'firstName': 'Fermín ...
1  {'name': 'Cristhian Stuani', 'slug': 'cristhia...
2  {'name': 'Robert Lewandowski', 'firstName': ''...
3  {'name': 'İlkay Gündoğan', 'slug': 'ilkay-gund...
4  {'name': 'Ferran Torres', 'slug': 'ferran-torr...

               playerCoordinates        xg
0  {'x': 12.9, 'y': 62.2, 'z': 0}  0.089518
1   {'x': 2.6, 'y': 57.3, 'z': 0}  0.186681
2   {'x': 7.7, 'y': 47.9, 'z': 0}  0.195696
3   {'x': 9.1, 'y': 54.2, 'z': 0}  0.134803
4  {'x': 24.8, 'y': 41.9, 'z': 0}  0.024742
```

```
data_sofascore['player_name'] = [x['name'] for x in data_sofascore['player']]
data_sofascore['X'] = [x['x'] for x in data_sofascore['playerCoordinates']]
data_sofascore['Y'] = [x['y'] for x in data_sofascore['playerCoordinates']]
data_sofascore['player_name']
```

```
data_sofascore = data_sofascore[['player_name', 'X', 'Y', 'xg']]
print(data_sofascore.head())
```

```
          player_name     X     Y        xg
0        Fermín López  12.9  62.2  0.089518
1    Cristhian Stuani   2.6  57.3  0.186681
2  Robert Lewandowski   7.7  47.9  0.195696
3      İlkay Gündoğan   9.1  54.2  0.134803
4       Ferran Torres  24.8  41.9  0.024742
```

```
print(data_understat.head())
```

```
               player      X      Y        xG
0            Raphinha  0.920  0.624  0.027585
1  Robert Lewandowski  0.954  0.412  0.135576
2          João Félix  0.872  0.391  0.076541
3            Raphinha  0.969  0.488  0.654123
4  Robert Lewandowski  0.932  0.514  0.126038
```

```
len(data_understat)
```

```
46
```

```
len(data_sofascore)
```

```
46
```

```
set(data_understat['player'])
```

```
{'Artem Dovbyk',
 'Cristhian Stuani',
 'David López',
 'Fermín López',
 'Ferrán Torres',
 'Frenkie de Jong',
 'Ilkay Gündogan',
 'Jhon Solis',
 'João Cancelo',
 'João Félix',
 'Jules Koundé',
```

```
 'Miguel Gutiérrez',
 'Raphinha',
 'Robert Lewandowski',
 'Sávio',
 'Valery Fernández',
 'Viktor Tsygankov',
 'Yan Couto'}
```

```
set(data_sofascore['player_name'])
```

```
{'Artem Dovbyk',
 'Cristhian Stuani',
 'David López',
 'Fermín López',
 'Ferran Torres',
 'Frenkie de Jong',
 'Jhon Solís',
 'João Cancelo',
 'João Félix',
 'Jules Koundé',
 'Miguel Gutiérrez',
 'Raphinha',
 'Robert Lewandowski',
 'Sávio',
 'Valery Fernández',
 'Viktor Tsygankov',
 'Yan Couto',
 'İlkay Gündoğan'}
```

```
data_understat.describe()
```

	X	Y	xG
count	46.000000	46.000000	46.000000
mean	0.876217	0.528065	0.156358
std	0.069200	0.108335	0.181039
min	0.728000	0.301000	0.013073
25%	0.835500	0.464000	0.045203
50%	0.902500	0.536000	0.081206
75%	0.923000	0.595500	0.130447
max	0.984000	0.812000	0.654123

```
data_sofascore.describe()
```

	X	Y	xg
count	46.000000	46.000000	46.000000
mean	12.200000	47.452174	0.135148
std	6.578382	10.731133	0.142474
min	2.600000	18.800000	0.009018
25%	7.700000	40.475000	0.044768
50%	9.600000	46.500000	0.084365
75%	16.525000	53.400000	0.159605
max	26.600000	69.900000	0.694513

```
data_sofascore_scaled = data_scale(data_sofascore[['X', 'Y', 'xg']])
```

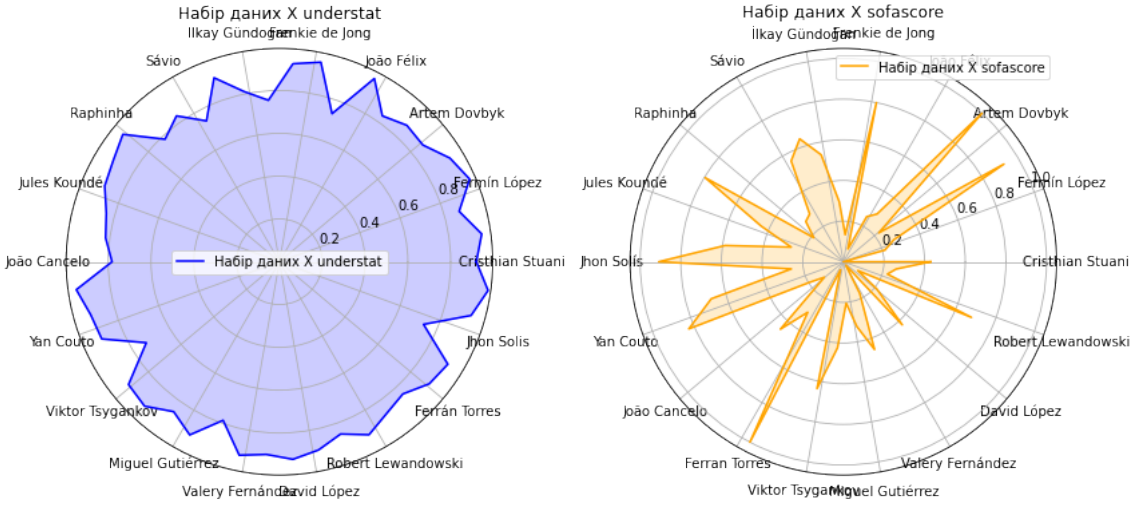
```
data_sofascore_scaled = pd.DataFrame(data_sofascore_scaled, columns=['X', 'Y', 'xg'])
print(data_sofascore_scaled.head())
```

```
          X         Y        xg
0  0.429167  0.849315  0.117434
1  0.000000  0.753425  0.259174
2  0.212500  0.569472  0.272326
3  0.270833  0.692759  0.183495
4  0.925000  0.452055  0.022938
```

```
import numpy as np
import matplotlib.pyplot as plt


#
def radar_chart(ax, data, label, color):
    angles = np.linspace(0, 2*np.pi, len(data), endpoint=False)
    data = np.concatenate((data, [data[0]]))  #
    angles = np.concatenate((angles, [angles[0]]))  #
    ax.plot(angles, data, label=label, color=color)
    ax.fill(angles, data, alpha=0.2, color=color)
```

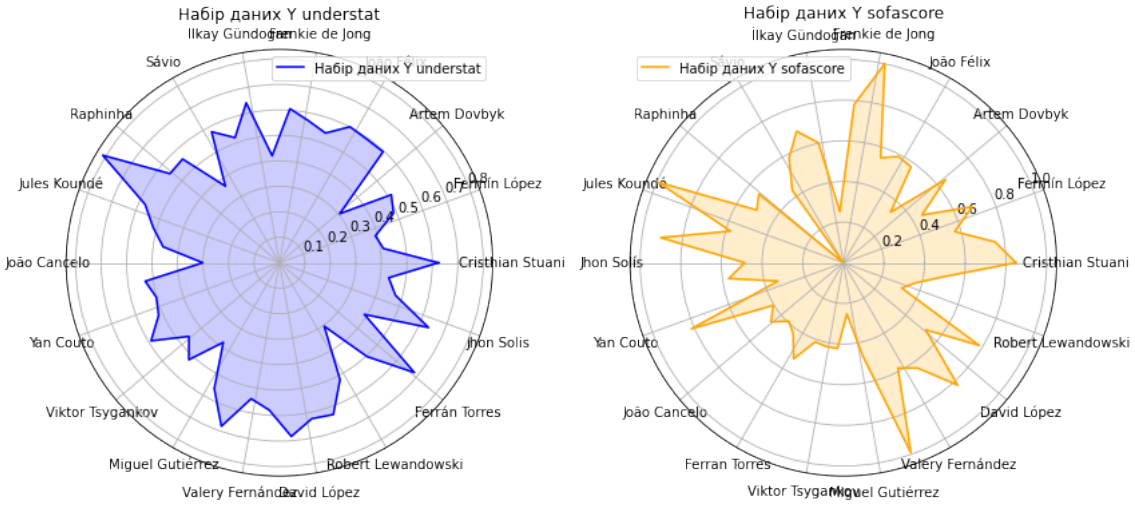
```
#          (       ).                    - İlkay Gündoğan
categories_understat = list(set(data_understat['player']))
categories_sofascore = list(set(data_sofascore['player_name']))
```

```
#           1
plt.figure(figsize=(12, 6))
ax1 = plt.subplot(1, 2, 1, polar=True)
radar_chart(ax1, data_understat['X'], '       X understat', 'blue')
ax1.set_xticks(np.linspace(0, 2*np.pi, len(categories_understat), endpoint=False))
ax1.set_xticklabels(categories_understat)
ax1.set_title('       X understat')
ax1.legend()

#           2
ax2 = plt.subplot(1, 2, 2, polar=True)
radar_chart(ax2, data_sofascore_scaled['X'], '       X sofascore', 'orange')
ax2.set_xticks(np.linspace(0, 2*np.pi, len(categories_sofascore), endpoint=False))
ax2.set_xticklabels(categories_sofascore)
ax2.set_title('       X sofascore')
ax2.legend()

#
plt.tight_layout()
plt.show()
```



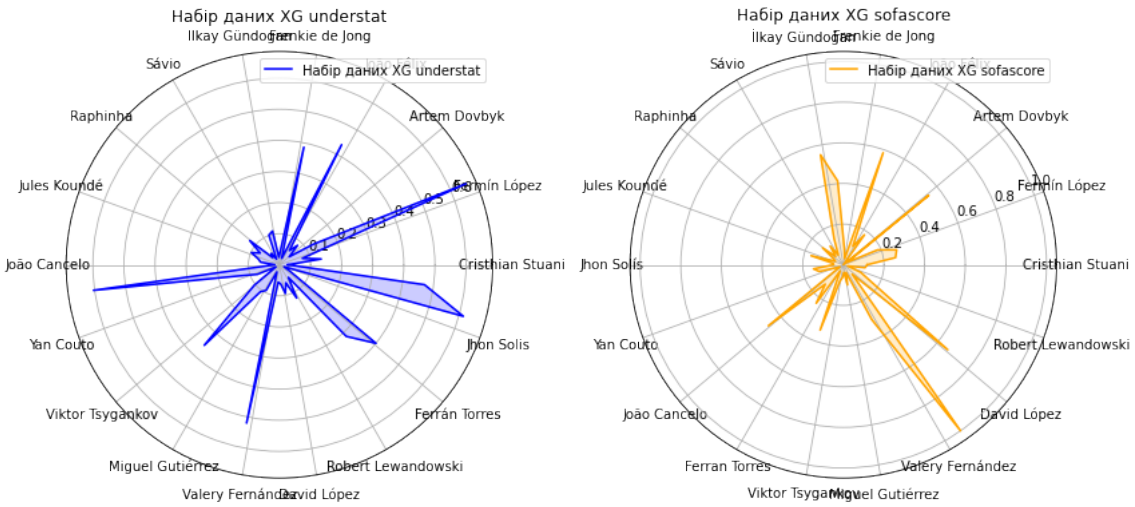

```
#           1
plt.figure(figsize=(12, 6))
ax1 = plt.subplot(1, 2, 1, polar=True)
radar_chart(ax1, data_understat['Y'], '       Y understat', 'blue')
ax1.set_xticks(np.linspace(0, 2*np.pi, len(categories_understat), endpoint=False))
ax1.set_xticklabels(categories_understat)
ax1.set_title('       Y understat')
ax1.legend()
```

```
#           2
ax2 = plt.subplot(1, 2, 2, polar=True)
radar_chart(ax2, data_sofascore_scaled['Y'], '       Y sofascore', 'orange')
ax2.set_xticks(np.linspace(0, 2*np.pi, len(categories_sofascore), endpoint=False))
ax2.set_xticklabels(categories_sofascore)
ax2.set_title('       Y sofascore')
ax2.legend()

#
plt.tight_layout()
plt.show()
```




```
#           1
plt.figure(figsize=(12, 6))
ax1 = plt.subplot(1, 2, 1, polar=True)
radar_chart(ax1, data_understat['xG'], '       XG understat', 'blue')
ax1.set_xticks(np.linspace(0, 2*np.pi, len(categories_understat), endpoint=False))
ax1.set_xticklabels(categories_understat)
ax1.set_title('       XG understat')
ax1.legend()

#           2
ax2 = plt.subplot(1, 2, 2, polar=True)
radar_chart(ax2, data_sofascore_scaled['xg'], '       XG sofascore', 'orange')
ax2.set_xticks(np.linspace(0, 2*np.pi, len(categories_sofascore), endpoint=False))
ax2.set_xticklabels(categories_sofascore)
ax2.set_title('       XG sofascore')
ax2.legend()
```

```
#
plt.tight_layout()
plt.show()
```



Comparison of player statistics

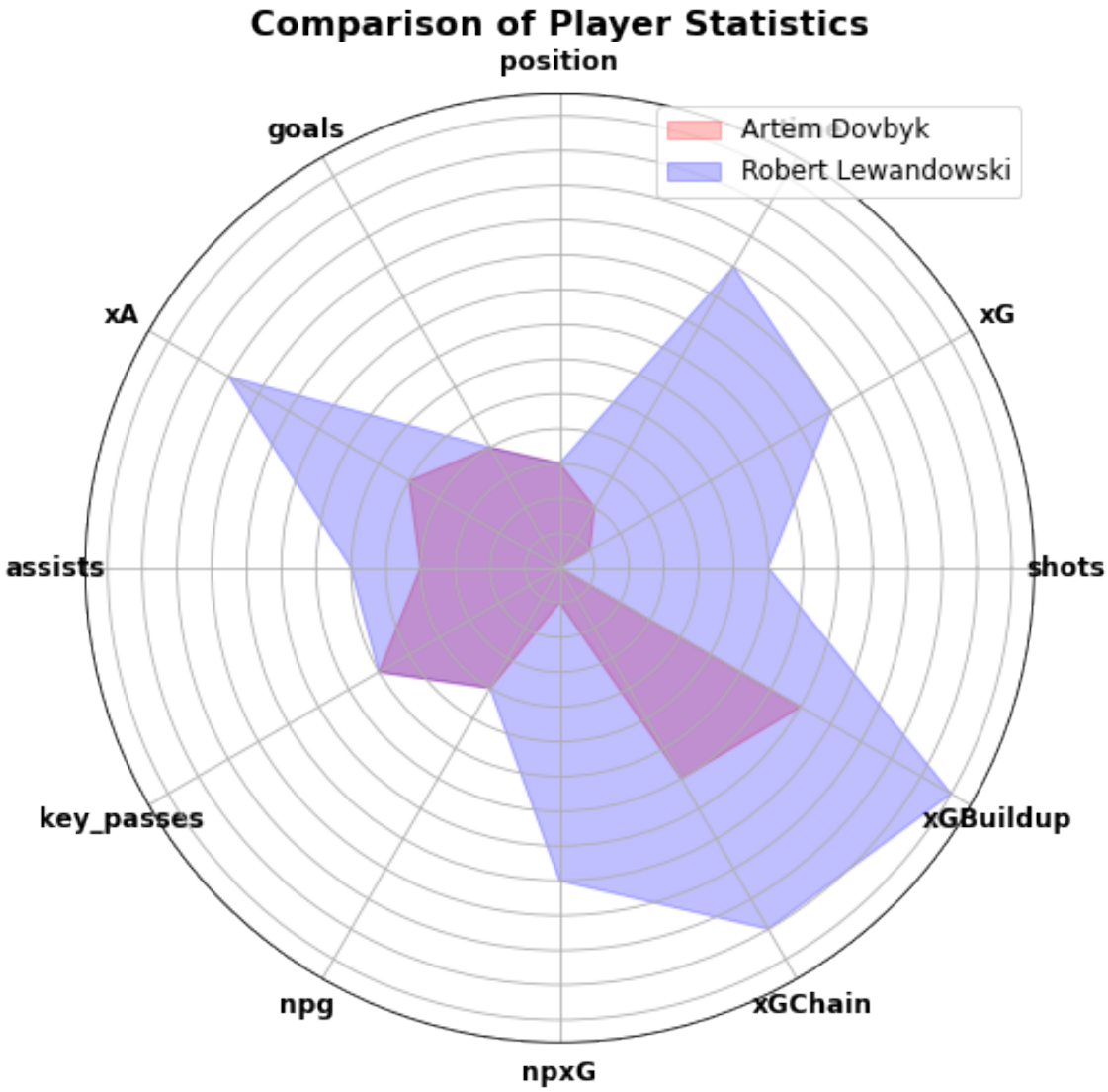
```
import json
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

#      JSON
player1_file = './data/player_match_data_11736.json'
player2_file = './data/player_match_data_227.json'
```

```
#
player1_stats = pd.read_json(player1_file)
player2_stats = pd.read_json(player2_file)

#       DataFrame
df1 = pd.DataFrame(player1_stats)
df2 = pd.DataFrame(player2_stats)

#print(df1.describe())
#df1.info()
#print(df1.head())
```

```
#print(df2.describe())
#df2.info()
#print(df2.head())
```

```
#
stats_labels = [ 'shots', 'xG', 'time', 'position', 'goals', 'xA', 'assists', 'key_passes',

#
player1_values = [df1[label].iloc[0] for label in stats_labels]
player2_values = [df2[label].iloc[0] for label in stats_labels]

#
num_vars = len(stats_labels)
angles = np.linspace(0, 2 * np.pi, num_vars, endpoint=False).tolist()

#                          ,
player1_values += player1_values[:1]
player2_values += player2_values[:1]
angles += angles[:1]
```

```
#
fig, ax = plt.subplots(figsize=(8, 8), subplot_kw=dict(polar=True))
ax.fill(angles, player1_values, color='red', alpha=0.25, label='Artem Dovbyk')
ax.fill(angles, player2_values, color='blue', alpha=0.25, label='Robert Lewandowski')
ax.set_yticklabels([])
ax.set_xticks(angles[:-1])
ax.set_xticklabels(stats_labels, fontsize=12, fontweight='bold')
ax.legend(loc='upper right', fontsize='large')
plt.title('Comparison of Player Statistics', size=16, weight='bold')
plt.show()
```


Comparison of Player Statistics
position
goals
xG
shots
xGBuildup
xGChain
npxG
npg
key_passes
assists
xA
Artem Dovbyk
Robert Lewandowski