

## **How Did the Introduction of Video-Assistant Referees (VAR) in the English Premier League (2018/2019) Affect Fans' Enjoyment of Football?**

### **Introduction**

The Video-Assistant Referee (VAR) was introduced to the English Premier League in the 2019/2020 season, in an effort to correct in-game errors made by on-field match officials that may have a major impact on the outcome of the match. The Video-Assistant Referee uses various tools to enhance his decision on fouls leading to/preventing goals, penalty decisions, offsides, red card incidents etc. The current implementation of the VAR system uses technology to produce real-time and slow-motion replays, computer-generated virtual lines on the field and ball-tracking technology to achieve this.

Even though there has been an average increase in the accuracy of referee decisions when VAR is involved, making the game ultimately fairer, as requested by fans, there are mixed feelings towards the system. Some fans and pundits have even requested that it be removed because it's "ruining football". However, there are fans who appreciate the system and vie for it to stay.

Therefore, the goal of this project is to gain insight on the general attitudes of fans towards VAR and to analyze the sentiments of a group of football fans in order to determine if VAR has had a positive or negative impact on fans' enjoyment of football. Also, to examine possible reasons for these views on VAR. This will be attempted by using a natural language processing technique, sentiment analysis, on a collection of tweets containing "#VAR". Additionally, common statistical methods will be utilised to examine goal data and the findings will be displayed using data visualization techniques to improve interpretation of the results.

## Methodology

My methodological approach was to use both qualitative (primary data) and quantitative data (secondary data) to attempt to answer the research question and determine a reason for the result. The qualitative data was a set of tweets from Twitter users containing the hashtag “#VAR”. These tweets were collected using Twarc (a command-line tool for archiving Twitter JSON). Twarc was used to make calls to the Twitter API (developer access required) to retrieve English tweet strings containing “#VAR” and other details and store the results in a JSONL file which was later converted to a Comma Separated Value (.csv) file for exportation.

The tweets needed to be compiled and cleaned before sentiment analysis could be performed. So, the set of tweets were imported into a Jupyter Notebook as a .csv file so that Python 3 tools could be used to clean, curate and analyse the data. The notebook is separated in sections, indicated by markdown, for ease of reading. Firstly, the tweets and their details were stored in a pandas DataFrame so relevant information could be selected. Only the text body of the tweet is required for sentiment analysis so that was isolated and stored in a list.

The tweet texts contained items that would either hinder the sentiment analysis tool or were not relevant to performing a correct analysis. The cleaning process involved using regex expressions and the `re.sub()` function to substitute the unwanted content ( @ mentions, newline and carriage return characters, hyperlinks, Unicode characters) with a space or empty string where necessary. There was also some html code left decoded so `html.unescape()` from the `html` library was used to decode it. The clean tweets were then stored in a new list to preserve the original text for possible future processing.

After cleaning, sentiment analysis was performed on the tweets to determine if each tweet was negative, positive or neutral towards VAR. NLTK's (Natural Language Toolkit) pretrained sentiment analyzer, VADER (Valence Aware Dictionary and Sentiment Reasoner), was used to compute the polarity scores of which only the compound score was selected and stored as the value of the tweet text (key) in a dictionary. The mean of the compound scores was then calculated and the number of positive, neutral and negative tweets were computed. This was done by categorizing negative tweets as having a compound score of  $\leq -0.05$ , neutral being between  $> -0.05$  and  $< 0.05$  and positive being  $\geq 0.05$ . These totals were then used to calculate the percentage of each category and display the results in a pie chart.

The quantitative secondary data collected was English Premier League statistics from the 18/19 and 19/20 seasons. This data was collected from [https://fbref.com/en/comps/9/1889/2018-2019-Premier-League-Stats#all\\_league\\_summary](https://fbref.com/en/comps/9/1889/2018-2019-Premier-League-Stats#all_league_summary) as comma separated values and stored in two Excel spreadsheets. The delimited text was converted to tables and the headers were modified to facilitate exportation to Tableau. The tables were imported into Tableau and Tableau tools were used to create a side-by-side bar chart of total goals scored by each team over the two seasons. The chart was then saved as a PNG file.

### **Justification of Methods**

Twitter is the biggest platform for discussion among football fans where data is readily accessible through a developer's account which permits the use of Twitter's API. Therefore, Twitter provides a large enough sample size that is representative of the football fan population. The process for getting developer access to Twitter's API requires outlining your intended use of the tweet data to ensure that you carry out your research in an ethical manner. Usernames and any information linking a specific person to the tweets were excluded in the study because the

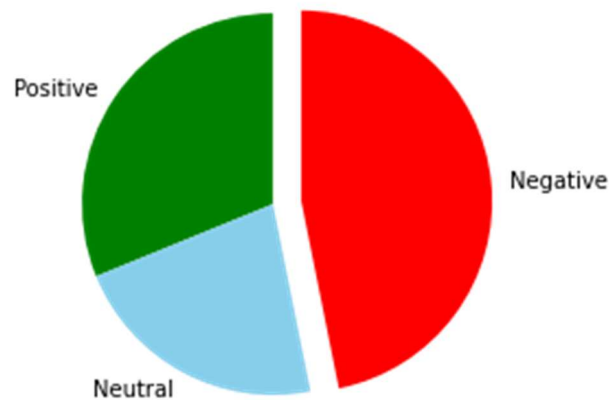
users did not give permission to do so and this would be seen as unethical. Only English tweets were collected in order to maximise the probability that the tweeter was an English Premier League fan. Also, this league was chosen because it is the most popular football league in the world and hence, would have the largest sample size of opinions.

The 18/19 and 19/20 season team goal tallies were chosen for comparison because VAR was first introduced in the 19/20 season and the more goals in a football game correlates to more enjoyment because “Most fans come to see goals being scored, and the more scored by your team the better” ( <https://www.significancemagazine.com/sports/693-has-english-league-football-become-less-exciting> ).

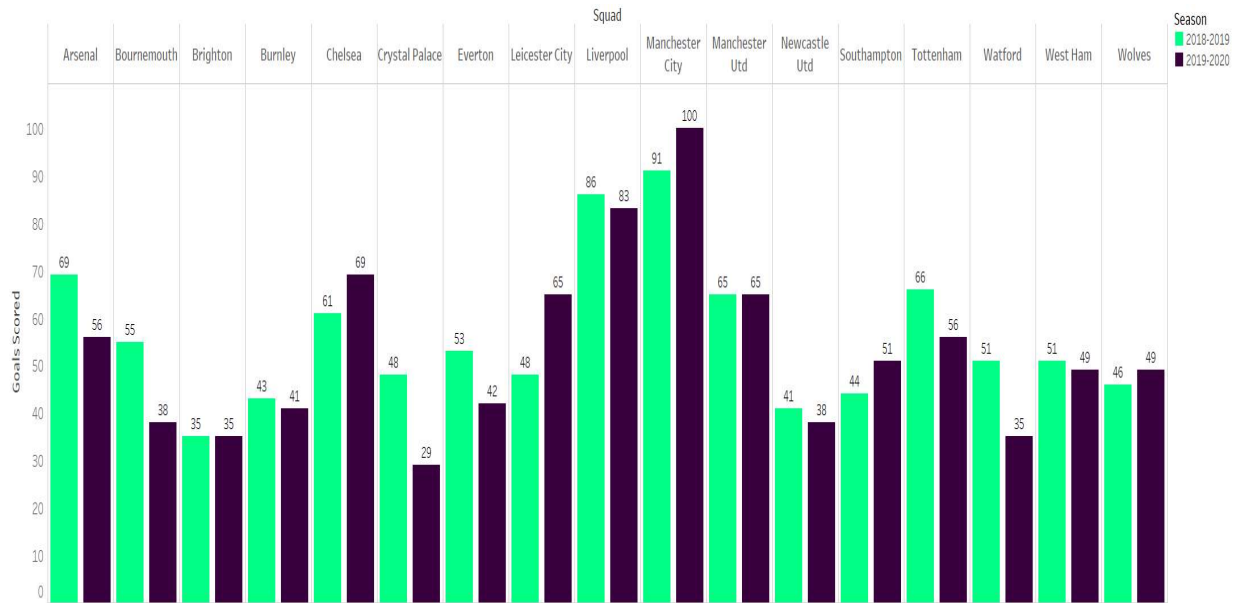
The tools/programs used were chosen based on their suitability for the project. Twarc is simple to use and allows easy conversion of tweet data in JSON format to CSV format. NLTK's VADER is pretrained and specialises in analyzing social media language which made it suitable for analyzing the tweets and Tableau allows easy importation of Excel sheets and visualisation of data to ease interpretation.

## Results

Out of the 9031 tweets (5023 unique/original tweets) that were collected, there was an average compound score of -0.1025. 31.18% of tweets were computed as positive, 21.98% as neutral and 46.84% as negative. This is represented in the pie chart below:



The comparison of the Premier League seasons shows that 52 less goals were scored after the introduction of VAR. The distribution is shown below in a side-by-side bar chart:



Due to the relegation and promotion rules of the Premier League, some squads were left out of the visualization as they had a goal record for a single season in the Premier League.

## Analysis of Results/Reflection

Given that the average compound score (-0.1025) of the collected tweets is less than 0.05, this signifies that on average, a tweet made about VAR is negative. Also, 46.84% of the tweets being negative supports this. To answer the research question, we must make the safe assumption

that negative statements towards a refereeing system in football indicates a lack of enjoyment of the sport at the time. Given the large sample size that was analyzed, it is safe to say that the majority of fans have negative or at least neutral feelings towards VAR. To attempt to answer why, the comparison of goals scored in the VAR introductory season and the previous was made, which was computed to be 52 less goals scored. This could possibly be caused by VAR. This would explain why fan's enjoyment of the sport decreased as the number of goals in a game is correlated with enjoyment.

However, this isn't conclusive, as VAR has an effect on cards distributed and the minutes of stoppage time in a game. These are factors which could contribute to the enjoyment of the sport and should be analyzed along with goals scored.

## **Conclusion**

To conclude, the high percentage of negative tweets about “#VAR” in the dataset indicate that the introduction of VAR in the English Premier League has decreased fan's enjoyment of football. A possible explanation for this was found to be the reduction in total goals scored compared to the previous season before the introduction of the Video-Assistant Referee.