# Analyzing Batting Performance and Platoon Advantage in the 2022 MLB Season Using Statcast Data

For this assignment, I followed a structured process to scrape, analyze, and visualize Statcast data from the 2022 MLB season. The goal was to extract insights into the relationship between exit velocity, launch angle, and two key performance metrics: Batting Average (BA) and Weighted On-Base Average (wOBA). I then broke down the results by analyzing the impact of pitcher and batter handedness on these metrics, focusing on potential platoon advantages.

The first step involved scraping the Statcast data, which I approached by breaking the season into smaller time frames. I collected data from March through November of 2022 and filtered it to only include pitches hit into play (type == "X"). This ensured that I was analyzing relevant batted ball data and excluded spring training games (game_type != "S"). Once the data was filtered, I combined the chunks into a comprehensive dataset, which served as the foundation for the analysis.

Next, I created scatter plots of exit velocity and launch angle, with BA and wOBA as the color-encoded metrics. The BA plot highlighted the simple probability of a hit based on how well the ball was struck. From this, I learned that line drives tended to result in higher BA values, while ground balls and flyballs were associated with lower BA. I included guidelines at 10, 25, and 50 degrees for ground balls, line drives, and flyballs, respectively, to provide a clear visual reference. The wOBA plot, in contrast, provided a more nuanced view of offensive value, assigning higher weights to outcomes like extra-base hits. Through the wOBA plot, I observed that balls hit harder and at optimal angles—especially line drives and flyballs—tended to produce higher wOBA values, indicating that wOBA is a better indicator of run-scoring potential than BA alone.

To dive deeper, I then created matrix plots for both BA and wOBA, faceting by pitcher and batter handedness. This step allowed me to explore how different handedness combinations affect offensive performance. For example, I observed that left-handed batters generally performed better against right-handed pitchers, which is a classic example of platoon advantage. The BA and wOBA plots provided complementary insights, with the wOBA plots revealing greater offensive value for certain handedness matchups, particularly when launch angles and exit velocities aligned favorably.

In conclusion, the analysis highlighted several key insights:

- **Exit velocity and launch angle** are critical factors in determining the success of batted balls. Line drives, in particular, yielded the highest BA and wOBA values.
- **wOBA** provides a more comprehensive measure of offensive value than BA, as it takes the quality of hits into account.
- **Platoon advantage** plays a significant role in determining player success. Certain handedness matchups offer performance advantages, which can inform strategic decisions for both hitters and pitchers.

This exploration of Statcast data using BA and wOBA has provided valuable insights into how players can maximize offensive output, both through optimal batted ball profiles and advantageous platoon matchups. Through this process, I not only gained a deeper understanding of the data but also honed my ability to translate raw data into actionable insights.

Here's a detailed breakdown of the results I observed from the different plots, including the platoon advantage plots and the others:

1. **Batting Average (BA) Plot**:
    - **Key Insight**: Balls hit with higher exit velocity and launch angles between 10 to 25 degrees (line drives) consistently showed the highest BA values. Ground balls, typically below 10 degrees, and flyballs, above 50 degrees, were less likely to result in hits.
    - **Result**: Line drives produced the highest success rate in terms of hits, as expected. This confirmed the general understanding that line drives are the most valuable batted balls when aiming for base hits.
2. **Weighted On-Base Average (wOBA) Plot**:
    - **Key Insight**: While the BA plot provided insights into hit probability, the wOBA plot showed that batted balls with higher exit velocities and optimal launch angles (around 25 degrees for line drives) had the highest wOBA values. This suggests that not all hits are equal in value; well-hit balls, especially extra-base hits, contribute more to scoring.
    - **Result**: Balls hit at higher exit velocities and optimal launch angles (line drives and flyballs) had higher wOBA values, demonstrating that wOBA better captures the offensive value of harder-hit balls compared to BA.
3. **Platoon Splits for BA (Pitcher vs. Batter Handedness)**:
    - **Key Insight**: The matrix plot faceted by pitcher and batter handedness revealed that left-handed batters generally performed better against right-handed pitchers in terms of BA, while right-handed batters had more success against left-handed pitchers.
    - **Result**: This result is consistent with the known platoon advantage theory, where hitters tend to have better visibility and timing against opposite-handed pitchers. In particular, left-handed batters showed higher BA values when facing right-handed pitchers, highlighting the classic platoon advantage.
4. **Platoon Splits for wOBA (Pitcher vs. Batter Handedness)**:
    - **Key Insight**: The wOBA matrix plot provided even more insight into the offensive value of platoon matchups. Left-handed batters not only had higher BA against

right-handed pitchers but also significantly higher wOBA, meaning that they produced more valuable offensive outcomes (e.g., extra-base hits).

- **Result**: The wOBA values for left-handed batters against right-handed pitchers were higher than for other matchups, reinforcing the platoon advantage. The right-handed hitter vs. left-handed pitcher matchup also showed improved offensive production, though the left-handed batter advantage was more pronounced.

**Summary of Key Results:**

- **Line drives (10-25 degrees)**, hit with higher exit velocity, had the highest BA and wOBA, showing the importance of both metrics in identifying well-hit balls.
- **Platoon advantage** was clear in both BA and wOBA metrics, with left-handed hitters performing better against right-handed pitchers, and vice versa.
- **wOBA provided deeper insights** into offensive value than BA, particularly in capturing the value of extra-base hits and higher-quality contact.

These results provide both a data-driven validation of well-known baseball principles (e.g., platoon advantage, the value of line drives) and a more granular understanding of offensive production through advanced metrics like wOBA.