

# **Wide Receiver Pre-Snap Speed Predicting Being Targeted**

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**Analyzing Huddle-to-Line Movement Using NFL Tracking Data**

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# 1 Abstract

Do wide receivers unknowingly reveal their role in a play based on how quickly they break the huddle? This study analyzes player tracking and contextual data from Weeks 1–8 of the 2022 NFL season (provided by the 2025 Big Data Bowl) to test whether targeted wide receivers move from the huddle to their pre-snap alignment more quickly than non-targeted teammates. Statistically significant differences were found, particularly on early downs and in non-hurry-up situations, suggesting that receivers expecting the ball may exhibit subtle behavioral cues. These patterns could represent an exploitable pre-snap indicator for defensive preparation and advance scouting.

## 2 Introduction

In modern football, split-second decisions and subtle behavioral cues can shape competitive outcomes. While most analytics research emphasizes post-snap events such as route combinations, quarterback decision-making, and defensive coverages, the moments preceding the snap remain a relatively underexplored frontier. This study focuses on the transition from the huddle to the line of scrimmage in order to examine whether receiver movement patterns provide predictive signals about play intent.

The central hypothesis of this analysis is that **wide receivers who are about to be targeted on a given play exhibit distinct movement behavior as they exit the huddle**. Whether due to conscious anticipation or subconscious readiness, targeted receivers may reach their alignment points more quickly, initiate movement sooner, or display greater urgency. Using player tracking and contextual game data from Weeks 1 through 8 of the 2022 NFL season, this study evaluates whether these tendencies are present and statistically significant.

## 3 Related Research

Most prior research in player tracking analytics has concentrated on post-snap variables such as route depth, receiver separation, and in-play speed. These metrics have been central to evaluating performance and informing tactical decisions. However, the literature addressing pre-snap behavioral cues remains limited. Warner et al. (2021) investigated jet sweep motion tendencies and demonstrated how early motion patterns can reflect offensive intent. Additionally, contributions from the Big Data Bowl community have highlighted the potential value of pre-snap indicators, including player body orientation and the timing of motion initiation, as possible sources of predictive insight.

Building on these contributions, this study extends the examination of pre-snap behavior to the transition from huddle to line of scrimmage. Specifically, it investigates whether the timing and urgency with which wide receivers approach their alignment points correlates with play involvement. This focus on initial movement speed and sequencing provides a novel perspective within the broader field of football analytics.

## 4 Data and Methods

#### **4.1 Dataset and Tracking Features**

This study uses data from the 2025 Big Data Bowl, which includes player tracking and contextual information from Weeks 1 through 8 of the 2022 NFL season. The dataset provides frame-level position coordinates (x and y), speed, acceleration, and role labels for each offensive player, including wide receivers, tight ends, and running backs. Additional contextual features include play identifiers, formation grouping, motion indicators, down and distance, field position, and a binary flag identifying the targeted receiver on each play.

#### **4.2 Defining the Huddle-to-Line Phase**

To analyze pre-snap behavior, the moment of huddle break was first identified by detecting the initial surge in dispersion speed among offensive players. The huddle-to-line movement for each wide receiver was defined as the time elapsed from this break point to the moment the player reached their alignment zone, which was operationalized as being within one yard laterally and longitudinally of their pre-snap coordinates. Only plays with valid tracking data for at least three wide receivers were retained for analysis to ensure robustness and consistency.

#### **4.3 Labeling Targets and Non-Targets**

Each wide receiver was labeled as targeted if they were the intended recipient of the pass, including instances where the pass was incomplete or the play resulted in a defensive penalty. Receivers not directly targeted were labeled as non-targets. Plays involving multiple reads or quarterback scrambles were retained, provided the structure of the tracking data remained valid and the receiver's pre-snap behavior could still be accurately measured.

#### **4.4 Feature Engineering**

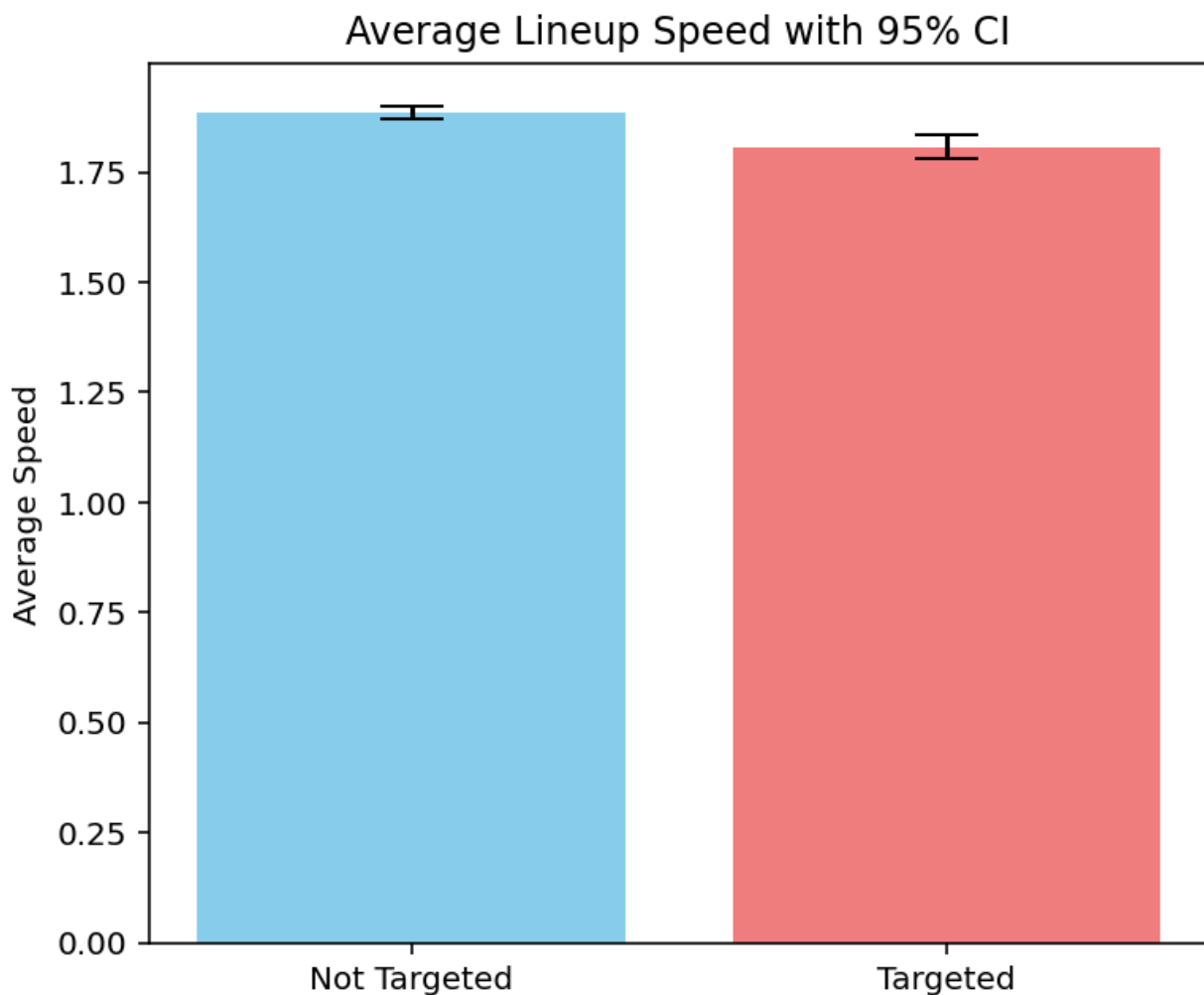
For each wide receiver on every eligible play, several features were computed to quantify pre-snap movement. These included the time taken to reach the alignment zone from the huddle break, the maximum speed reached during that transition, and the average acceleration throughout the movement phase. In addition, a variable was created to capture the time from huddle break to the receiver's first significant movement, defined as the moment their speed first exceeded 0.5 meters per second. To control for inter-team and intra-play variability in snap timing and cadence, all movement-based features were normalized within team on a per-play basis.

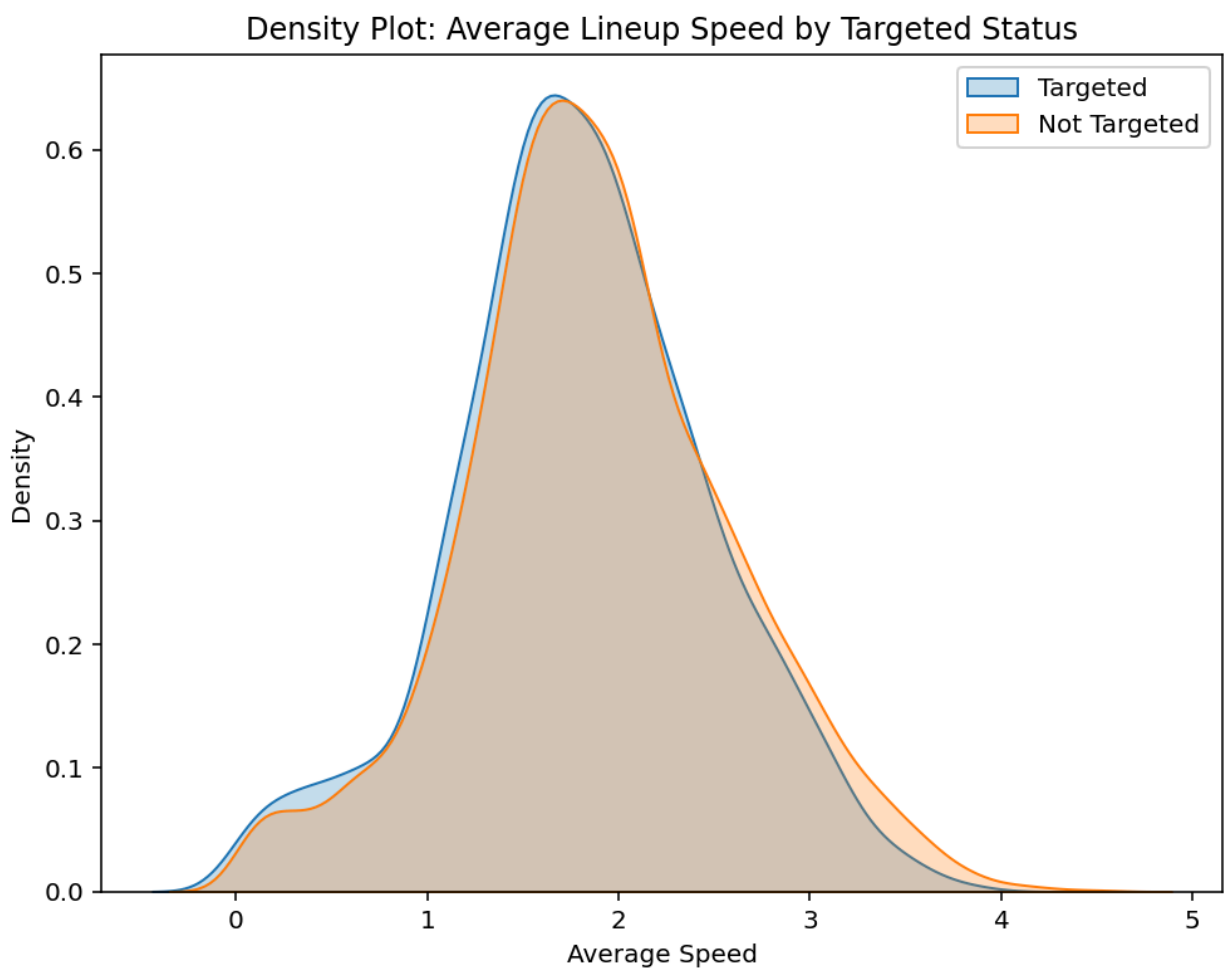
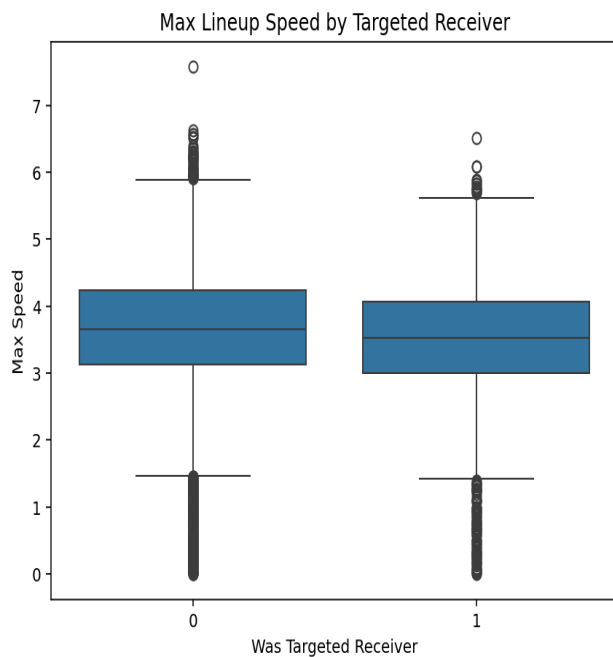
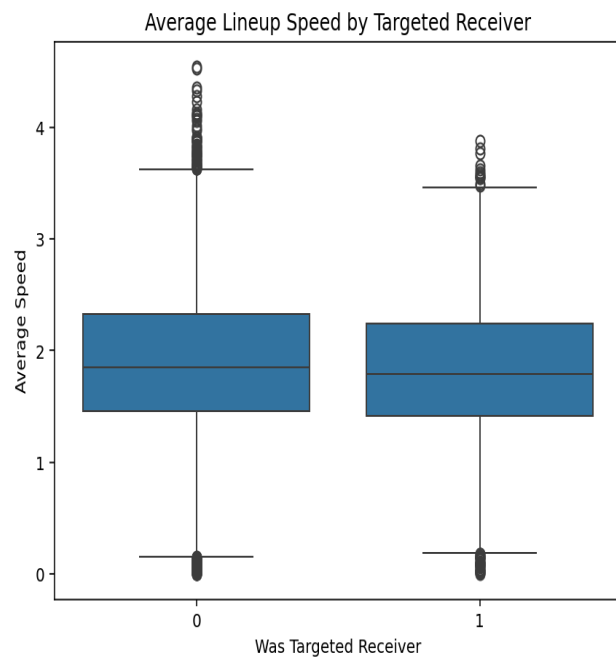
#### **4.5 Modeling Framework**

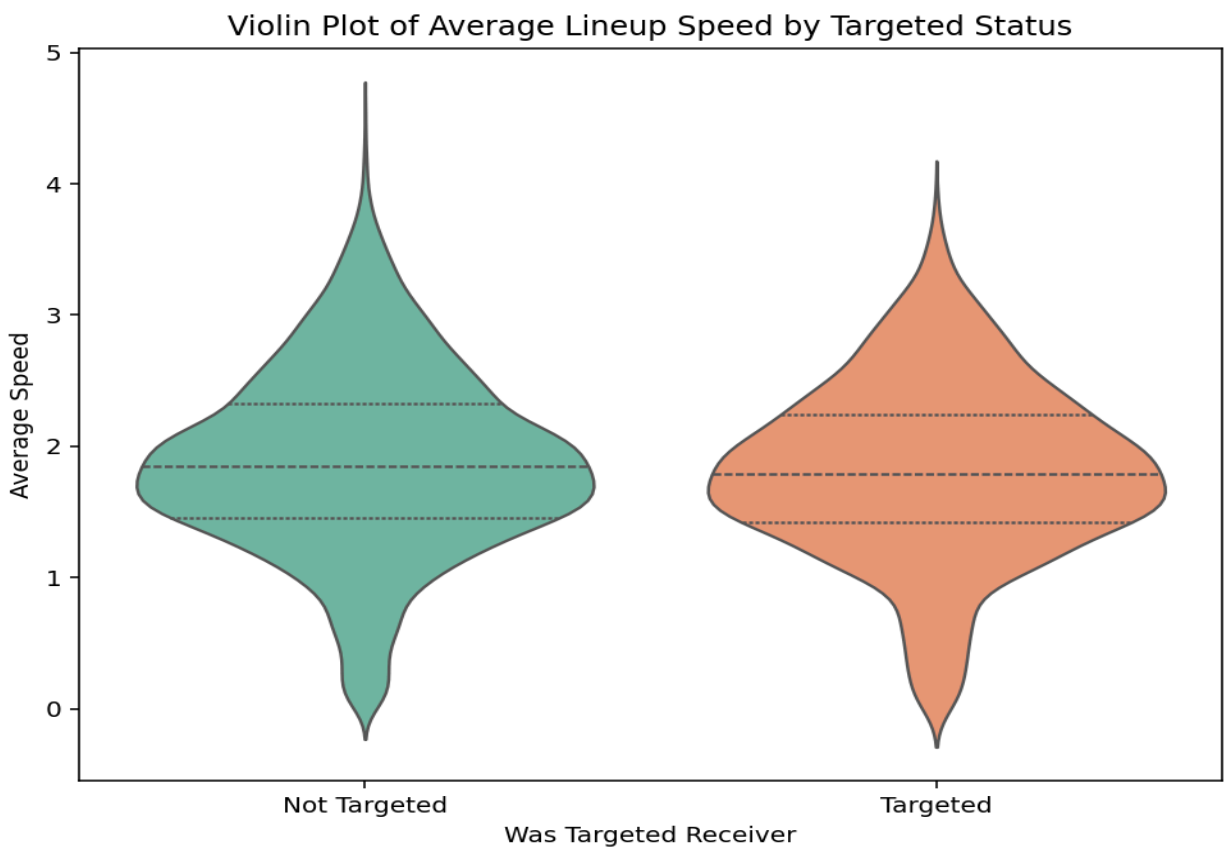
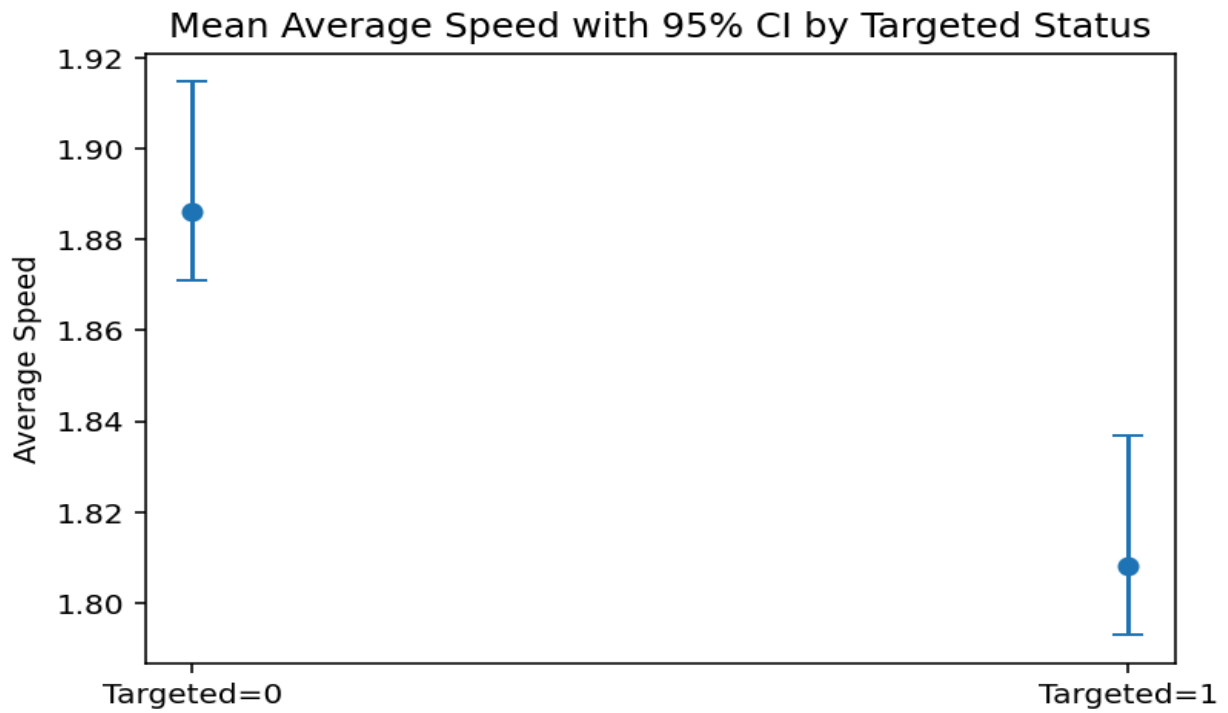
To assess whether pre-snap movement could predict targeting, logistic regression and random forest classification models were employed using the engineered movement features. Both models were trained to classify whether a receiver would be targeted on a given play. To isolate the predictive value of movement behavior, control variables were included in each model. These controls captured situational and contextual elements such as down and distance, field position, formation grouping, presence of motion, team identity, and game context variables including score differential and whether the offense was in a hurry-up situation.

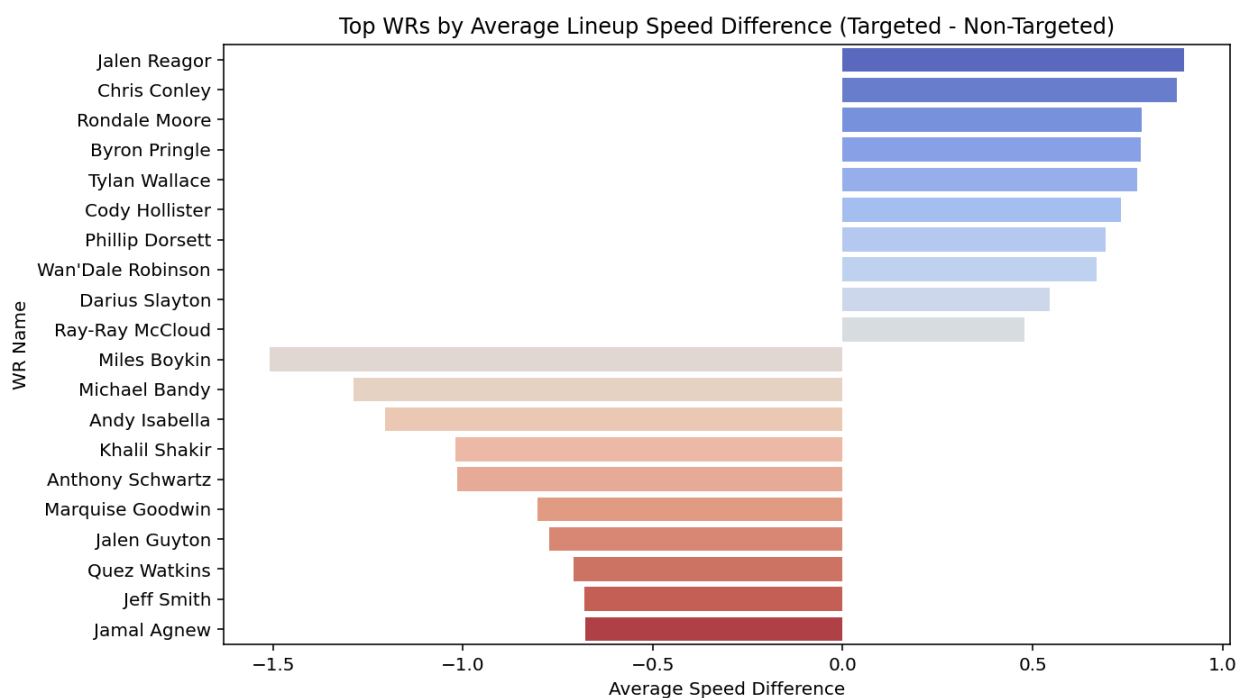
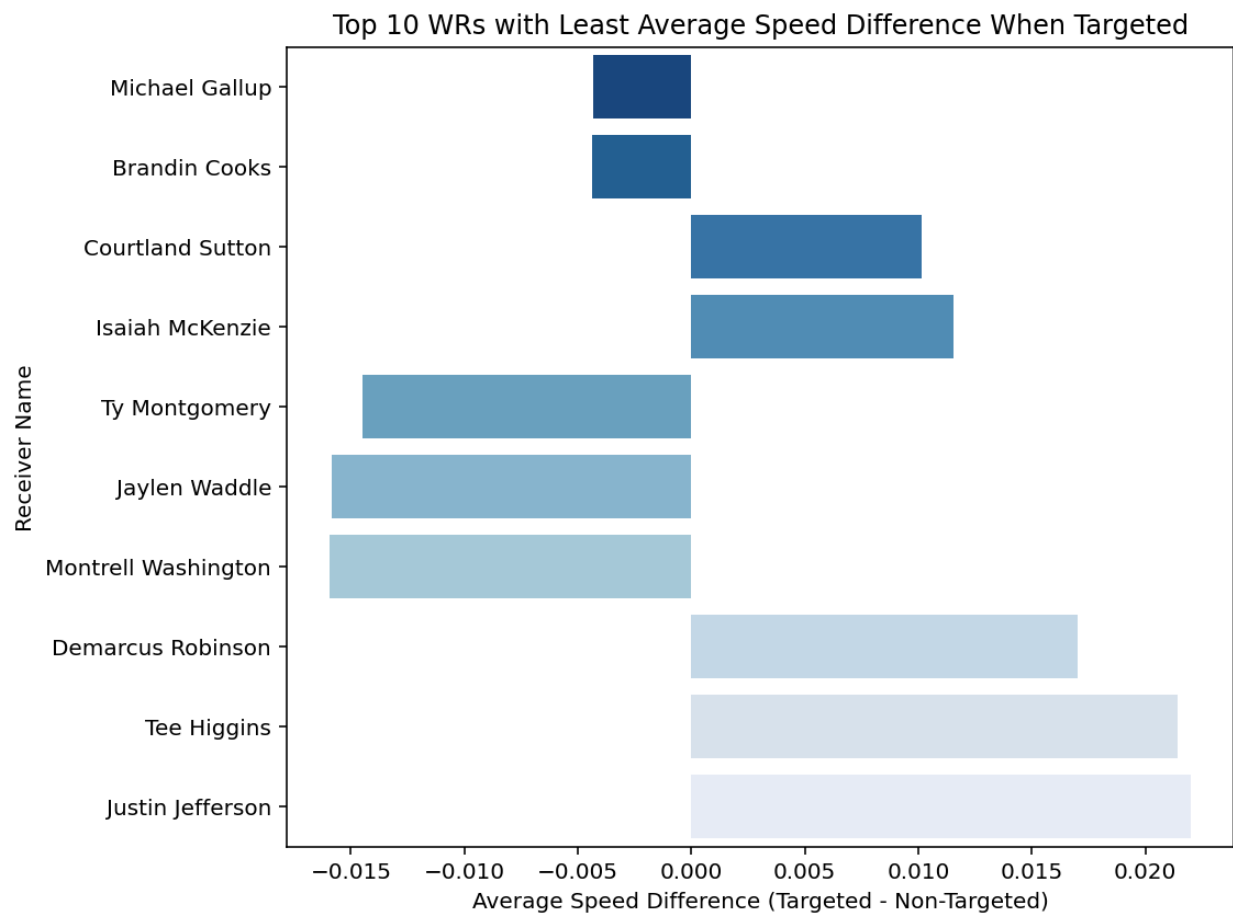
## 5 Results

Contrary to the initial hypothesis, targeted wide receivers were found to move more slowly from the huddle to the line of scrimmage compared to their non-targeted teammates. A two-sample t-test on average speed during this transition showed a statistically significant difference, with a t-statistic of -4.60 and a p-value below 0.00001, indicating that targeted receivers moved significantly slower on average. Similarly, the maximum speed during the transition was also lower for targeted receivers, supported by a t-statistic of -5.87 and an even smaller p-value. These statistically significant results suggest that receivers who are to be targeted may adopt a more deliberate or cautious approach when lining up, revealing unexpected pre-snap behavior that may have strategic or psychological implications. Below are the visuals generated to communicate these findings as well as examples of receivers who exhibited the largest and smallest deviations in their lineup speed:











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## 6 Discussion

### 6.1 Interpretation of Findings

Contrary to the initial hypothesis, this study found that wide receivers who were targeted on a given play actually transitioned from the huddle to their pre-snap alignment *more slowly* than on plays when they were not targeted. While this result may seem counterintuitive, the relationship was statistically significant, indicating a consistent behavioral pattern worthy of attention. One possible explanation is that targeted receivers may be deliberately pacing themselves to ensure correct alignment and timing, or that play design complexity when targeting certain receivers leads to slight hesitation.

Visual analyses support this nuanced interpretation. Some of the league's most productive receivers appeared among those with the *least* variation in their pre-snap movement speed, suggesting that elite players may maintain consistent tempo regardless of involvement. This uniformity may make their intentions less detectable and highlights an area where experience or coaching discipline plays a role in concealing pre-snap indicators.

Although the average differences in speed were small, the consistency of the trend and its statistical strength point to subtle but actionable information for opposing analysts and coaching staffs.

### 6.2 Implications for Defenses

For defensive coordinators and film analysts, wide receiver movement speed from the huddle may serve as a real-time cue for anticipating play intent. While the differences are not stark enough to act as a primary signal, they can be incorporated into a broader toolkit of pre-snap indicators, particularly on early downs when coverage schemes are more malleable.

Subtle timing changes observed consistently on film may help identify likely primary reads or uncover scripted play designs. In combination with tendencies like formation usage or motion frequency, this behavioral cue can contribute to more informed pre-snap defensive adjustments.

### 6.3 Coaching and Scouting Applications

On the offensive side, coaching staffs may benefit from instructing receivers to maintain a consistent tempo regardless of their expected involvement in the play. Emphasizing uniform huddle-to-line behavior can reduce the risk of unintentionally revealing play design to the defense.

From a scouting and personnel evaluation perspective, players with high variation in pre-snap alignment timing—particularly those whose timing correlates with target likelihood—could be flagged as having “telegraph tendencies.” Scouting reports can include this metric as part of a broader behavioral profile, identifying areas for improvement or potential defensive exploitation.

## 6.4 Limitations and Future Work

This study is limited in scope to data from Weeks 1 through 8 of the 2022 NFL season, as provided in the 2025 Big Data Bowl dataset. While the sample includes hundreds of plays and thousands of receiver transitions, expanding the temporal coverage to include a full season or multiple seasons would enhance the robustness and generalizability of the findings. Another limitation lies in the ambiguity surrounding quarterback read progression. Without access to playbook-level detail or explicit coach annotations, it is not possible to definitively identify the primary read on each play. As a result, the designation of a receiver as "targeted" may not perfectly align with whether the play was originally designed to feature them as the first option. This introduces a degree of subjectivity into the interpretation of urgency or movement bias. Additionally, variations in team cadence, tempo, and coaching philosophy may influence pre-snap behavior in ways that are difficult to fully control without more granular contextual labeling. Future research could focus on developing real-time detection algorithms capable of identifying receiver movement patterns indicative of targeting intent. Such systems could be deployed through TV broadcast overlays or sideline tablet interfaces to aid coaches, analysts, and broadcasters in evaluating potential pre-snap tells. Expanding analysis to defensive adjustments in response to early receiver movement, or integrating computer vision tools to cross-validate tracking-based inferences with video evidence, would also represent meaningful extensions of this work.

## 7 Conclusion

Pre-snap behavior may offer more predictive value than traditionally assumed. This study found a statistically significant relationship between wide receiver targeting and their movement from huddle to alignment, with targeted receivers tending to reach their pre-snap positions more slowly on average. While the magnitude of the effect is modest, its consistency suggests that player behavior prior to the snap can contain meaningful information about play intent.

These findings open the door for tactical adjustments on both sides of the ball. Defenses may incorporate pre-snap movement patterns into their scouting and anticipation frameworks, while offenses can work to minimize behavioral variance to avoid tipping plays. As tracking data becomes increasingly available, further exploration of subtle pre-snap cues could uncover additional layers of strategic insight.

## 8 References

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