Motion: A Defensive Perspective

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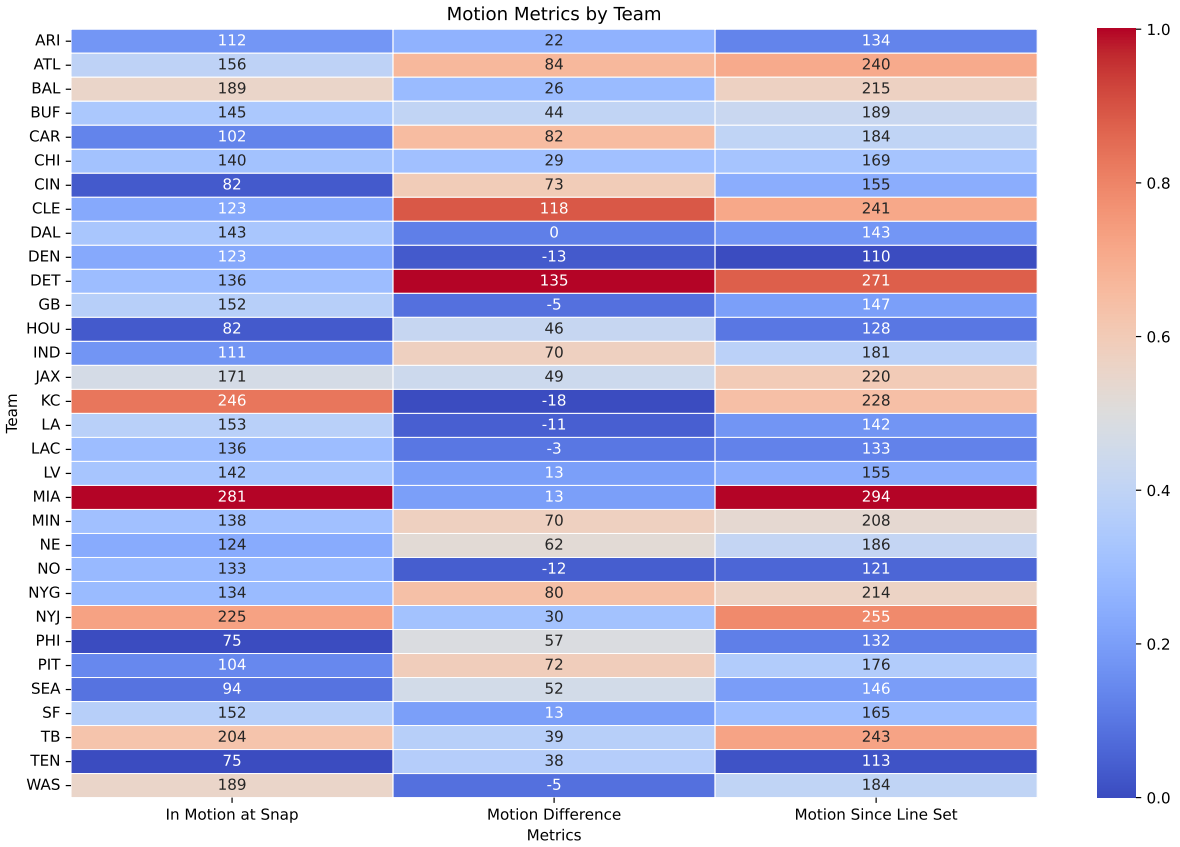
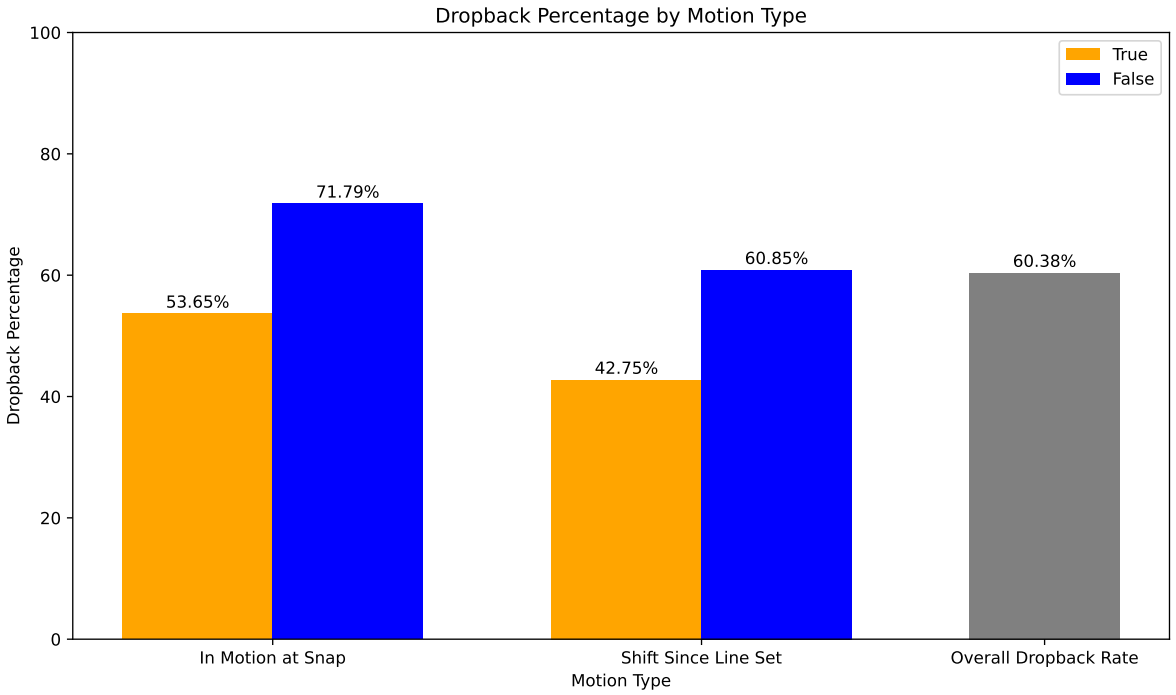
In recent years, NFL teams have increasingly incorporated motion into their playbooks, with a particular focus on how offenses can innovate and exploit defensive weaknesses using motion. Motion, as a tool for offensive advantage, has proven effective in helping offenses gain leverage and manipulate defensive schemes. However, what often gets overlooked is how this offensive motion can help defenses. The question remains: how can the defense use the motion to its advantage? Does it provide clues as to whether the offense is more likely to pass or run? Is there a correlation between motion and whether the ball will be thrown to the wide receiver in motion? Moreover, it's crucial to examine which offensive schemes tend to incorporate motion most often. Additionally, from a defensive perspective, we should explore the effectiveness of defensive motions. How successful are cornerbacks (CBs) when blitzing at the moment of the snap? How does the defensive movement influence play outcomes, particularly in terms of disrupting the offensive flow? By taking this defensive perspective on motion, we can gain deeper insight into not only how motion affects offensive strategy but also how it shifts the overall dynamics of the game. This broader understanding of motion's role in football could offer new strategies for both offensive and defensive coordinators looking to capitalize on this evolving trend.

How NFL Teams Used Motion



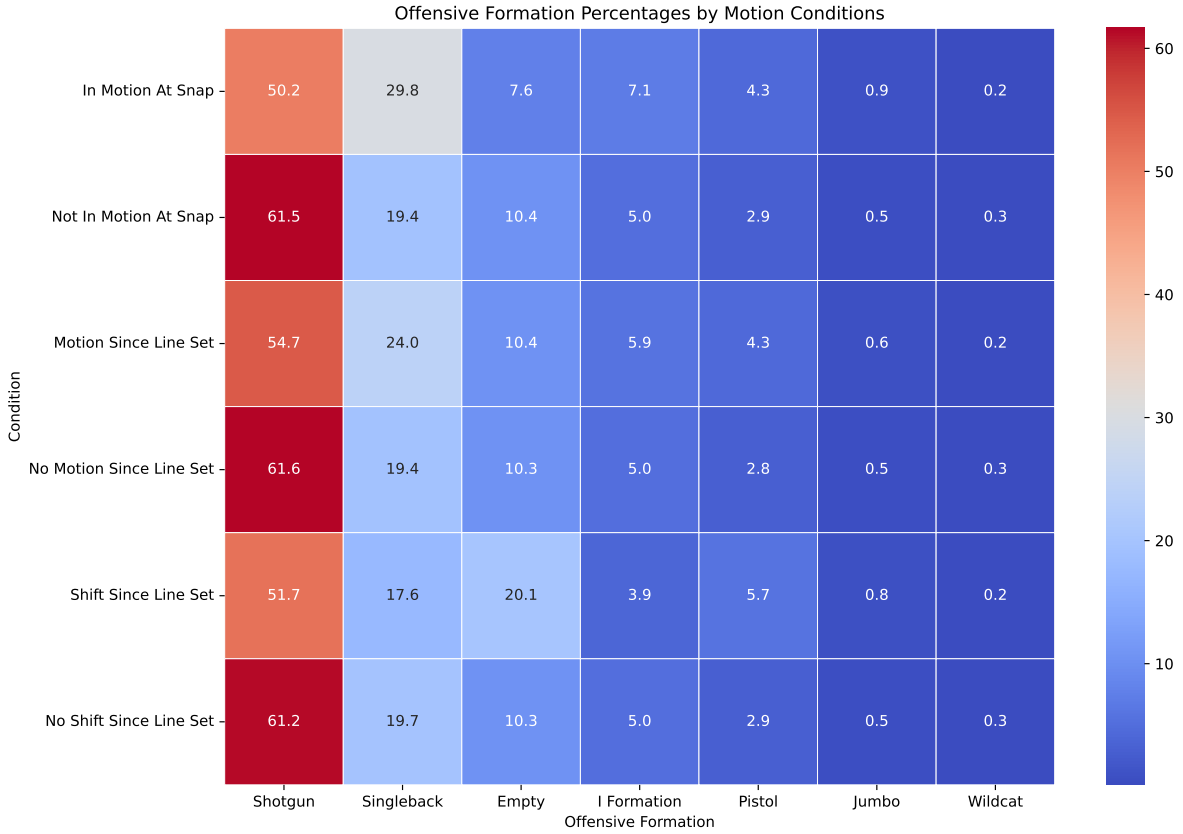
This heatmap highlights team tendencies regarding pre-snap motion. Teams like Miami (281) and Kansas City (246) frequently run motion at the ball snap, making it critical for defenses to prepare for fast, dynamic shifts during the snap. Conversely, teams like Detroit (135) and Cleveland (118) show the largest "motion differences," indicating that while they often initiate pre-snap motion, their players are set at the time of the snap. This distinction reveals that Miami and Kansas City are likely using motion to create confusion during the play, while Detroit and Cleveland may use it for adjustments and misdirection before settling into a static formation. Understanding these nuances allows defenses to prepare tailored responses, such as focusing on maintaining coverage discipline against motion-heavy offenses or preemptively aligning to counter motion-based misdirection.

How Motion Affected Play Calling



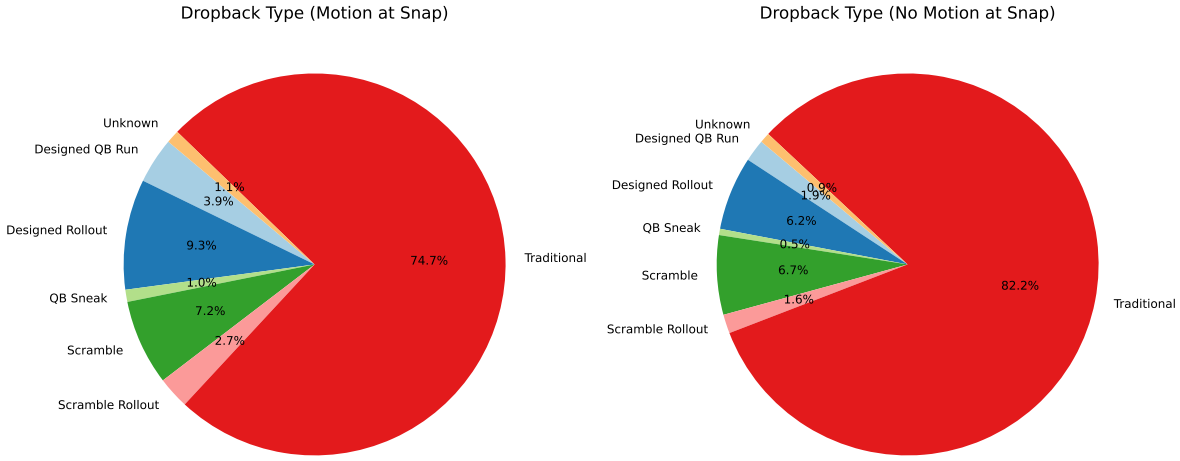
When motion occurs at the snap, the dropback percentage is 53.65%, which is lower than the overall dropback rate of 60.38%. This suggests that offenses are slightly more inclined to run the ball when motion is present at the snap. Defenses can use this information to anticipate a higher likelihood of running plays in these scenarios, allowing linebackers and defensive linemen to prioritize run-stopping techniques and filling gaps. Conversely, when no motion occurs at the snap, the dropback rate rises to 71.79%, significantly above the overall rate. This indicates a strong tendency toward passing plays, prompting defenses to focus on pass coverage and increasing their pass-rush intensity. When offenses shift after the line is set, the dropback percentage is 42.75%, which is much lower than the overall dropback rate. This signifies that shifts are often used in plays designed to run the ball, providing defenses with a clear signal to prepare for runs. However, when no shift occurs, the dropback percentage increases to 60.85%, aligning closely with the overall dropback rate. This balance suggests that plays without shifts are less predictable, requiring defenses to remain adaptable and prepared for either outcome. Comparing these tendencies to the overall dropback rate helps defenses understand how motion influences offensive play selection and adjust their strategies accordingly.

What Formations Did Motion Come From



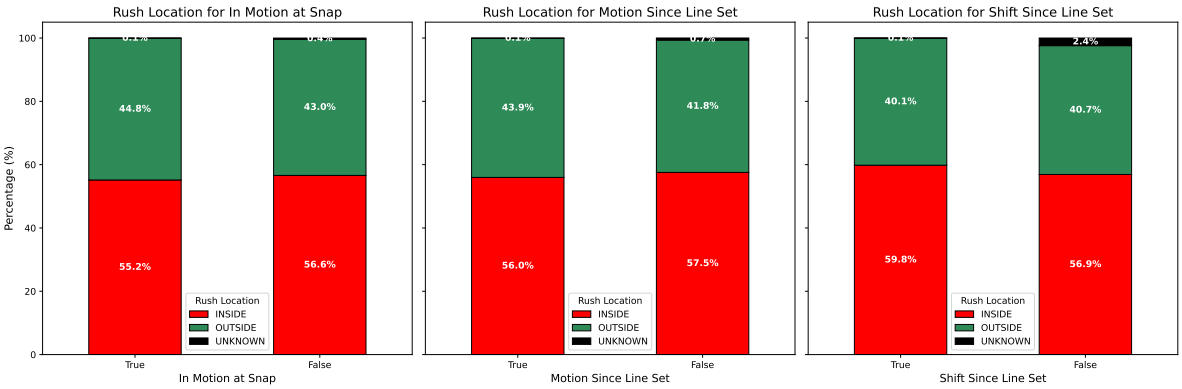
Teams are more likely to use motion when running plays from formations like Singleback or Empty backfield and less likely to use motion when in Shotgun or I-Form. This highlights how certain formations are tied to the use of motion, with offenses favoring motion in more versatile or deceptive setups. For defenses, knowing that motion is more common in certain formations allows them to focus on how the offense might be using motion to manipulate matchups or adjust their alignments, rather than guessing the formation itself, which is already known. In Singleback, where motion is used more often, the offense can more effectively disguise the intent to run or pass. This puts added pressure on the defense to quickly adjust to shifting players and ensure gap integrity against the run while maintaining proper coverage responsibilities. Conversely, when offenses are in Shotgun, motion is used less frequently, meaning defenses can often rely on static alignments and focus on pass coverage or blitzing schemes. Understanding which formations are more likely to involve motion allows defenses to prioritize preparation for how the offense will use motion to influence the play, such as creating mismatches or exploiting coverage. By recognizing these tendencies, defenses can better adapt to pre-snap shifts and maintain a strategic advantage against offenses trying to create confusion.

Predicting Dropback Designs



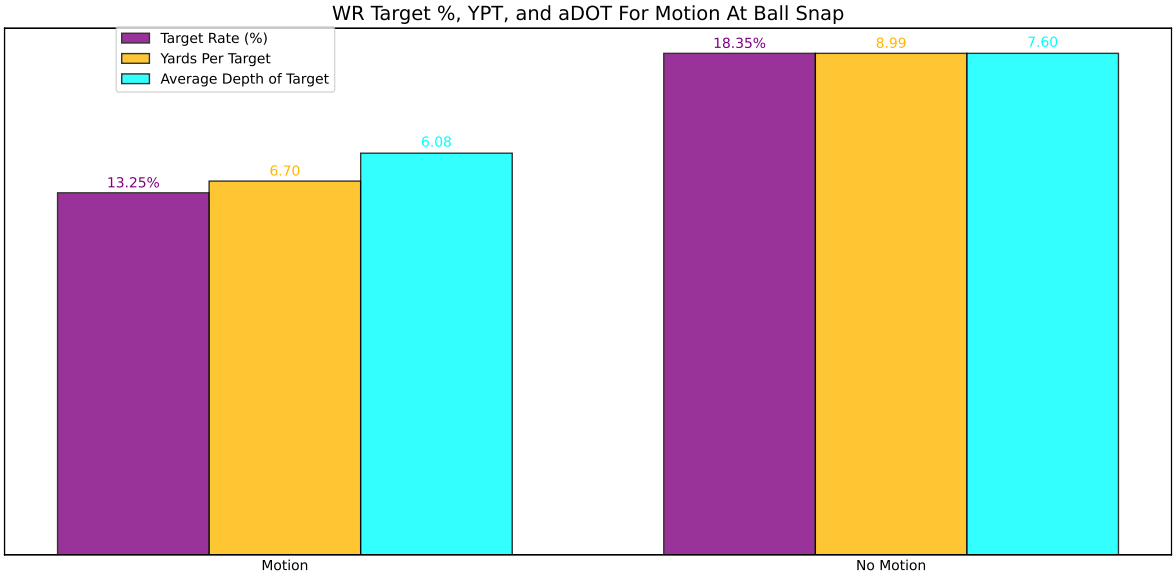
The charts compare dropback types for plays with and without motion at the snap. Plays without motion at the snap have a significantly higher reliance on traditional dropbacks (82.2%) compared to plays with motion at the snap (74.7%). This indicates that offenses tend to use more traditional dropback strategies when players are stationary. Notably, plays with motion at the snap show a greater use of designed rollouts (9.3% vs. 6.2%) and scramble rollouts (2.7% vs. 1.6%). This suggests that motion at the snap provides offenses with added flexibility to create movement-based passing plays, potentially forcing defenses to adjust more dynamically. The percentage of scrambles is also slightly higher with motion at the snap (7.2% vs. 6.7%), reflecting that motion might contribute to plays breaking down or creating opportunities for quarterbacks to improvise.

Predicting Running Lanes



When motion occurs at the snap, teams are more likely to run outside compared to when motion is not used. This indicates that offenses use motion at the snap to stretch the defense horizontally, aiming to create space on the edges. For defenses, this emphasizes the importance of edge containment. Linebackers and defensive ends must focus on setting the edge to prevent ball carriers from exploiting the perimeter, while safeties and cornerbacks should be prepared to provide support on outside runs. When motion occurs after the offense has set its formation, there is still a preference for outside runs. This continuation of outside-focused rushing plays suggests that offenses use motion to identify defensive alignments and manipulate spacing to favor perimeter runs. Defenses need to stay disciplined and avoid overcommitting to inside gaps, ensuring that the edge remains secure against these outside runs. In contrast, when shifts occur after the line has been set, teams are more likely to run inside. This shift to inside rushing plays likely takes advantage of defenses adjusting to the shift or TEs motioning in to block. Defenses can counter this by reinforcing interior gap assignments and ensuring that defensive tackles and linebackers are positioned to stuff inside runs. Recognizing these patterns allows defenses to respond appropriately based on the type of pre-snap movement, improving their ability to counter the offense's rushing strategy.

WRs in Motion at Ball Snap: The Decoy Effect

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Percentage of plays where a WR in motion at ball snap gets a rushing attempt: 4.57%
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The data shows that when a wide receiver is in motion at the snap, the target rate is lower (13.25%) compared to when the WR is stationary (18.35%). Additionally, the yards per target are also slightly lower (6.70) for WRs in motion versus stationary WRs (8.99). Lastly, the

aDOT for WRs in motion (6.08) is lower than stationary (7.60). This suggests that WRs in motion are often used as decoys rather than primary targets in passing plays. Furthermore, they are not as successfull when thrown to. Finally, the defense need not worry about the motioning WR beating them over the top, as the aDOT is lower. Offenses may utilize motion to distract defenders, create confusion in coverage assignments, or pull defenders out of position to open up space for other players. For defenses, recognizing this trend is valuable because it helps them avoid overcommitting resources to covering the WR in motion. Instead, defenders can focus on maintaining discipline and ensuring that other potential targets are adequately covered. For example, if the motion consistently pulls a safety or linebacker out of position, the offense can exploit that space with passes to other receivers or running plays. By understanding that motion often serves as a distraction, defenses can better anticipate the offense's true intentions and allocate their personnel accordingly, reducing the effectiveness of decoy plays.

Defensive Back Motion

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Mean Yards per Carry with CB/S Motion: 4.94
Mean Yards per Carry without CB/S Motion: 4.25
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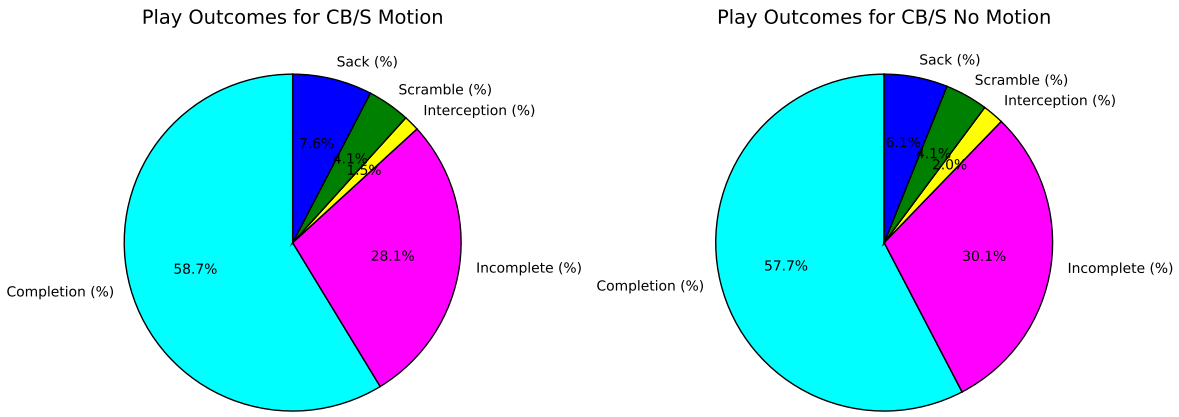

This manually written code identifies defensive motion by cornerbacks and safeties at the snap by analyzing tracking data. It calculates motion using a speed threshold (2 yards/second) at the ball snap event to flag if a defender is moving. The code aggregates this motion data at the play level, merging it with game and play-level data to differentiate between plays with and without defensive motion. By comparing play outcomes (like completions, sacks, and rushing yards), the code assesses how defensive motion impacts both passing and rushing plays.

CB/S motion leads to higher completion percentages, which may occur because it can leave a wide receiver or tight end uncovered if the motion is part of a blitz or if defenders fail to adjust effectively. This could result in easier passing opportunities for the quarterback,

especially when the defense sacrifices coverage to generate pressure. The lower interception rates with defensive motion suggest that quarterbacks are taking advantage of these openings with safer, higher-percentage throws, rather than being forced into risky decisions. Against the run, CB/S motion struggles, leading to higher mean yards per carry for the offense. This may happen because the motion creates gaps in the defensive front or misaligns defenders, making it easier for running backs to exploit space. This highlights a significant trade-off, as the disruption caused by defensive motion does not seem to translate to success in stopping the run game. On the positive side, defensive motion increases sack production. This is likely due to its effectiveness in disrupting offensive blocking schemes or confusing the quarterback's reads, leading to extended plays or breakdowns in protection. While CB/S motion has clear weaknesses, particularly against the run, its ability to generate pressure and create sack opportunities makes it a valuable tool in certain defensive play calls. Understanding these trade-offs is essential for deciding when and how to use defensive motion effectively.

Linebacker and EDGE Motion

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Mean Yards per Carry with LB/EDGE Motion: 4.27
Mean Yards per Carry without LB/EDGE Motion: 4.34
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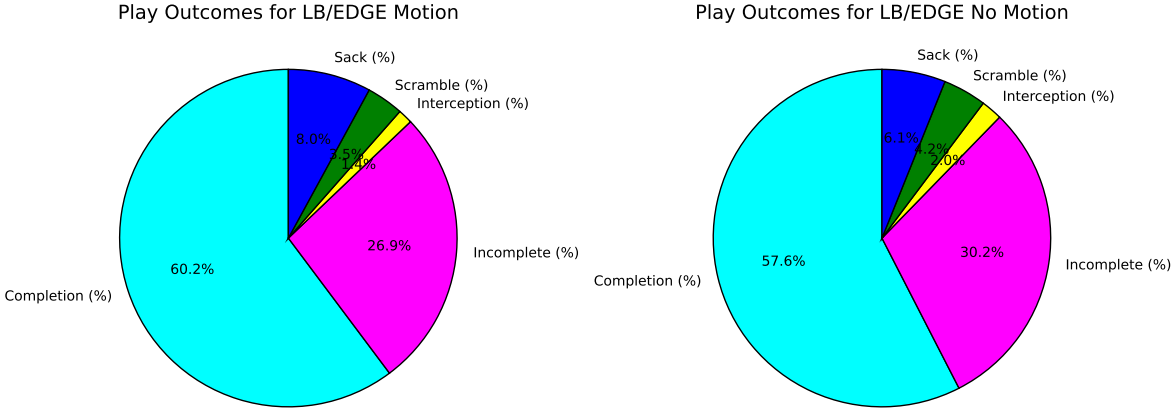

When linebackers and edge defenders are in motion, completion percentages increase, suggesting that the movement may cause coverage breakdowns or misalignments, making it easier for quarterbacks to complete passes. This can happen if the motion pulls defenders out of their assignments, leaving receivers open or forcing defenders to react more slowly. The lower interception rates with motion indicate that quarterbacks are likely once again taking advantage of these openings with safer, more controlled throws, avoiding risky deep passes or challenging throws into tight coverage. The presence of motion also results in an increase in sack production. This is likely because the motion creates confusion in blocking schemes or increases defensive rushing speed, leading to missed assignments or delayed pass protection. While the

motion increases pressure on the quarterback, it does not appear to significantly impact rushing outcomes, as mean yards per carry remain similar whether linebackers and edge defenders are in motion or not. This suggests that the run defense is largely unaffected by the pre-snap motion, and linebackers and edge players maintain their ability to fit against the run despite the movement. In summary, while linebackers and edge defenders in motion can disrupt the passing game and generate sacks, the motion doesn't seem to have a significant effect on the run game. The key takeaway is that while motion can increase pressure on the quarterback, it also opens up passing lanes, which can lead to higher completion percentages for the offense.

Summary of Data

In recent years, NFL teams have increasingly used motion to enhance offensive play designs, leading to more dynamic and unpredictable play calling. Motion has been particularly useful for offenses, but its impact on defenses is often underexplored. Key data points show that when motion occurs at the snap, offenses are more likely to run the ball, especially outside, compared to plays without motion. This highlights the need for defenses to prioritize edge containment when motion is present. Teams like Miami and Kansas City use motion aggressively to create confusion, while teams like Detroit and Cleveland use it for pre-snap adjustments. These tendencies allow defenses to tailor their strategies, focusing on maintaining coverage discipline against motion-heavy offenses or preemptively adjusting to misdirection. Additionally, formations like Shotgun see less motion, enabling defenses to focus more on pass coverage. On dropbacks with motion at the snap, teams employ QB rollouts at a much higher rate. Another significant finding is the use of motion by wide receivers (WRs). WRs in motion tend to have lower target rates and yards per target, suggesting they are often used as decoys. Recognizing this trend allows defenses to avoid overcommitting to the WR in motion and focus on other potential threats. Defensively, motion by cornerbacks and safeties leads to sack production, though it struggles against the run. Motion by linebackers and EDGE rushers also generate more pressure, but don't sacrifice the run game. This highlights the trade-offs of defensive motion, as it can generate pressure but also leaves the defense exploitable. Overall, these insights demonstrate the importance of understanding both offensive and defensive motion dynamics for developing effective strategies.