

Advantage Theory

The insufficiency of pre-snap data

Chris Clement - McGill University Football

Jamie Cook - University of Toronto Football

Tommy Denison - Edmonton Elks

Keagan Hall - McMaster University Football

Premise

Exploration of the principles of *advantage* as they relate to pre-snap data

Advantage theory is inspired by 46 combined seasons of coaching
62 games (7202 plays) were manually tagged from film to identify
whether the offense attacked *with advantage*

Illustration of positive effects of attacking *with advantage*

Demonstration of the limited utility of pre-snap data

Presentation of implementation process for advantage paradigm

What is Advantage?

For pass plays: Advantage exists when the number of offensive players \geq the number of defenders in a field zone

For run plays: Advantage exists when the number of blockers \geq the number of defenders in a field zone*

Advantage can exist in any of 3 field zones: boundary, box, field

Advantage is based on the distribution of players at the moment of attack

A play is attacks *with advantage* if advantage exists in the field zone being attacked

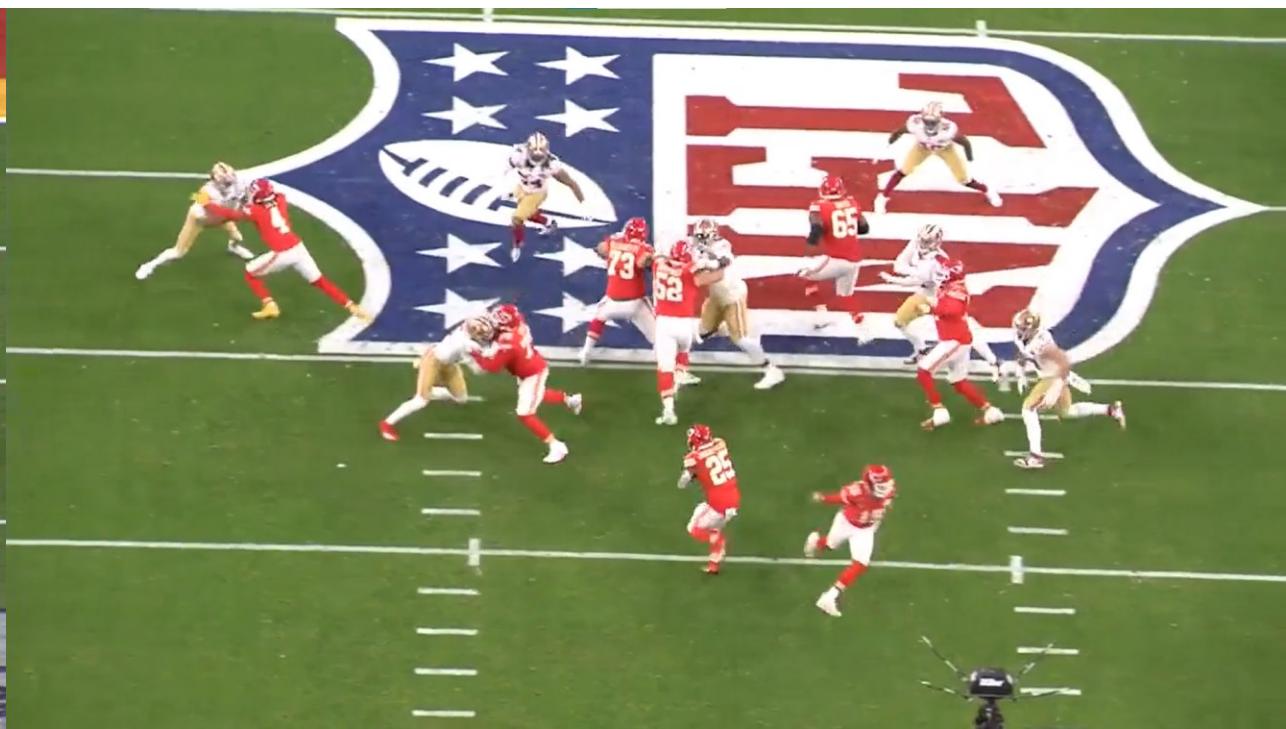
* Certain option plays allow the QB to be counted as a blocker

Illustrating Run Advantage

Attacking with Advantage
8 blockers, 8 defenders



Attacking without Advantage
6 blockers, 7 defenders



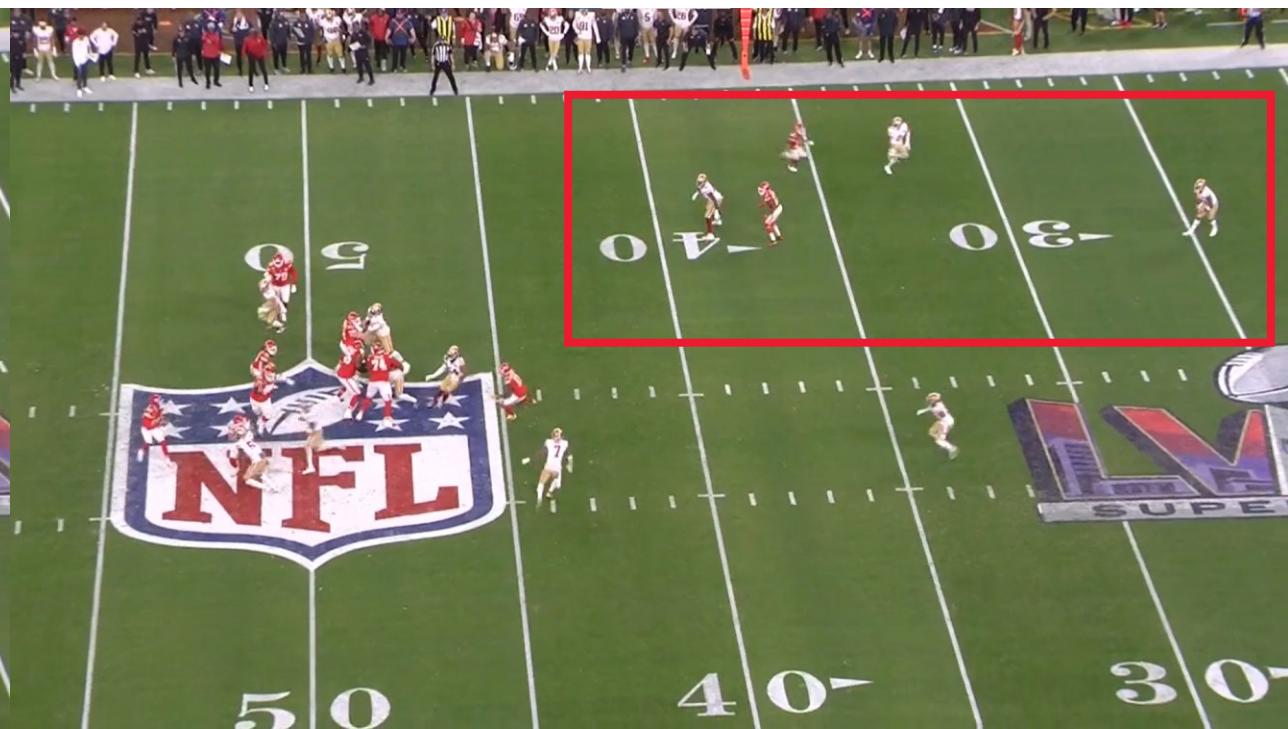
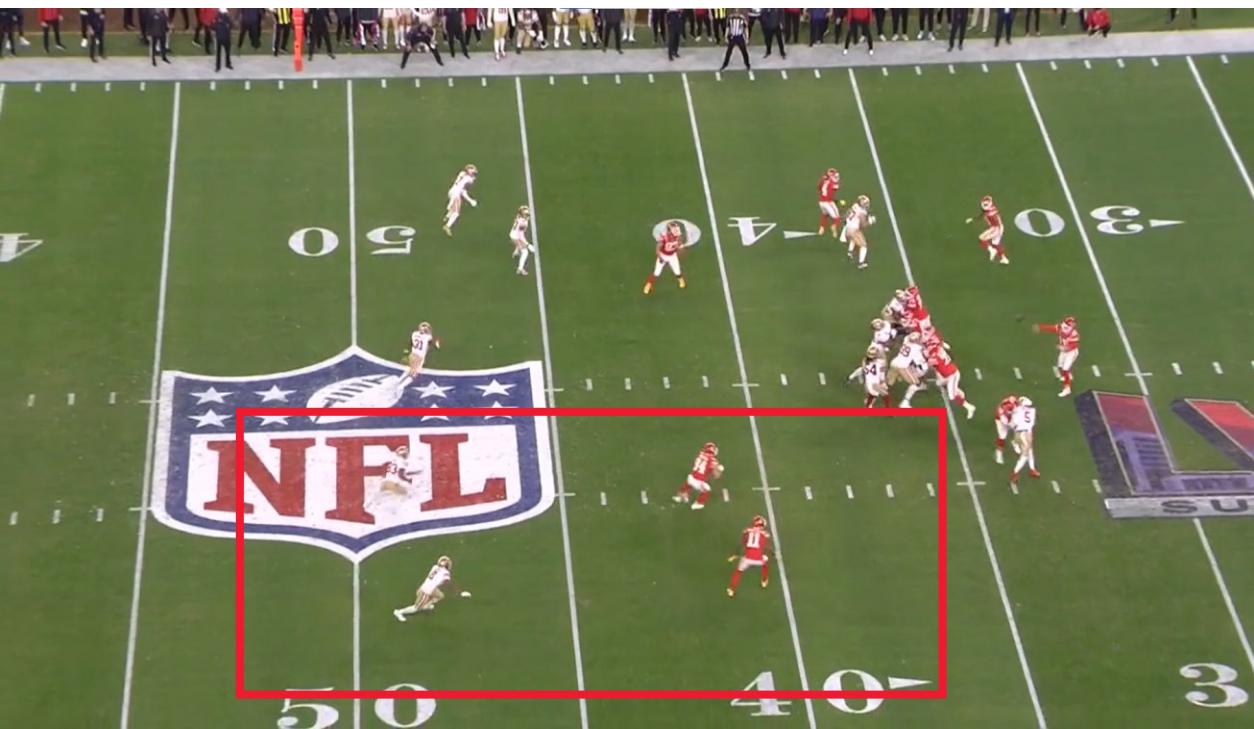
Illustrating Pass Advantage

Attacking with Advantage to field

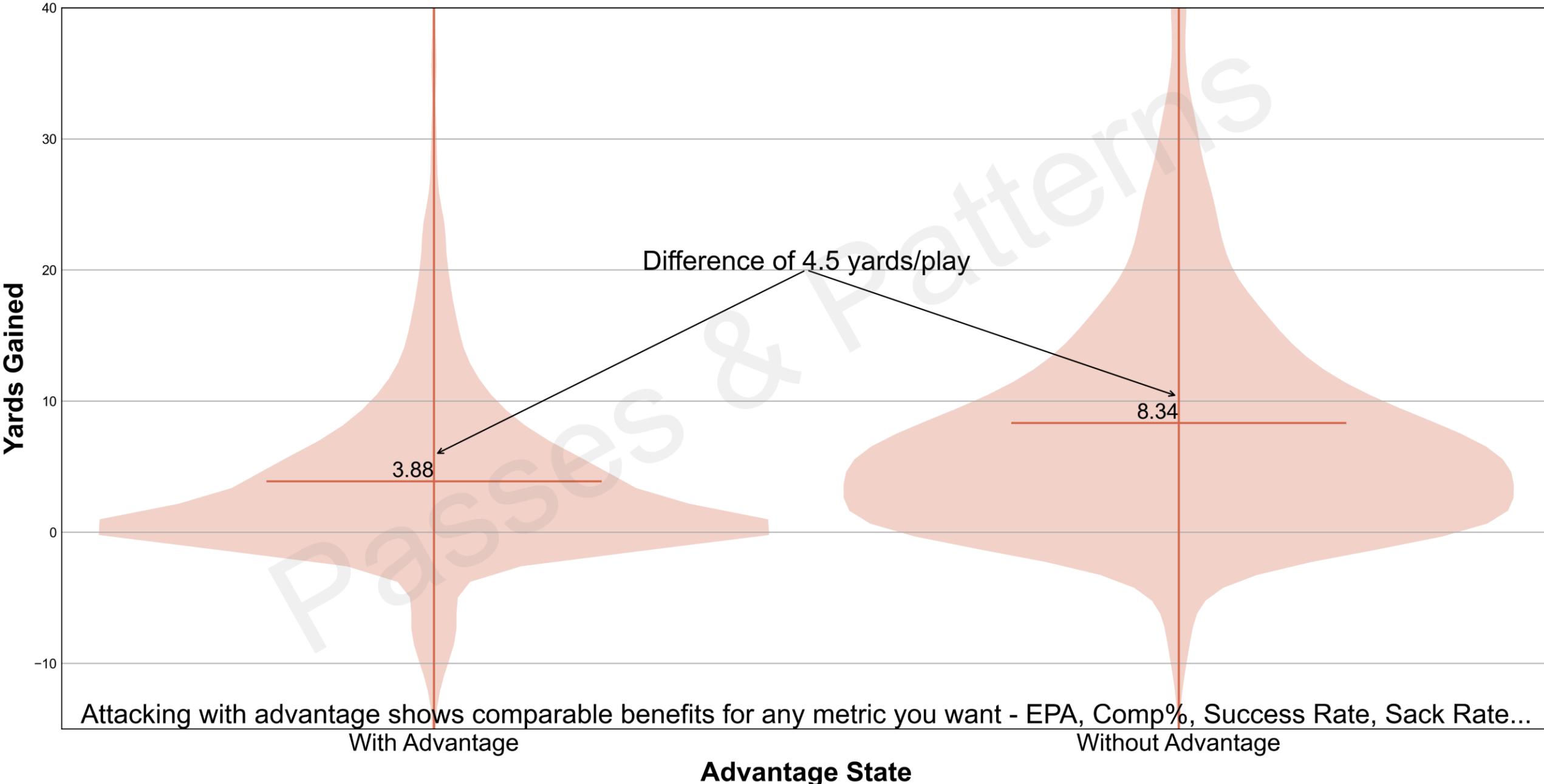
2 receivers, 2 defenders

Attacking without Advantage to boundary

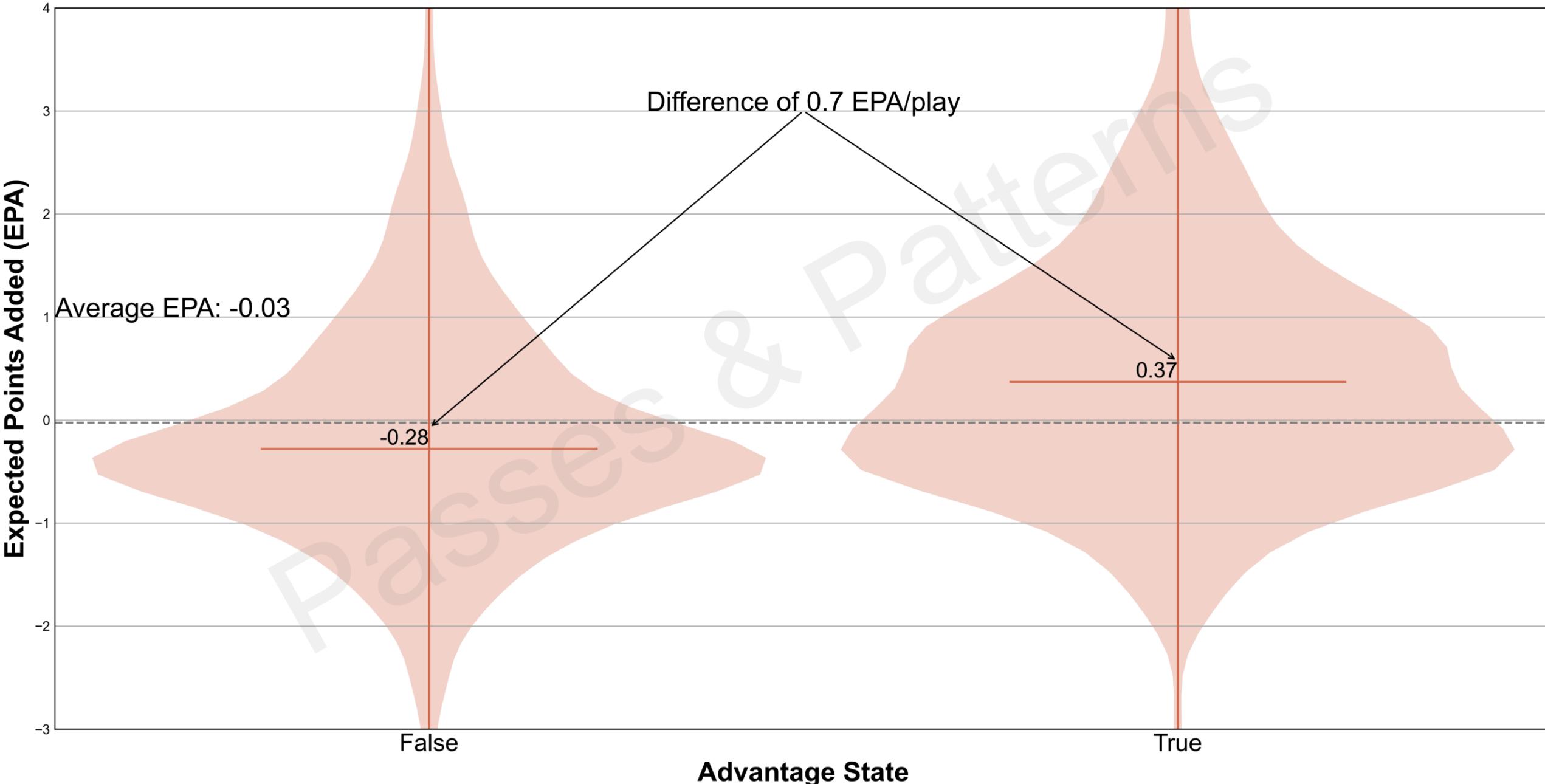
2 receivers, 3 defenders



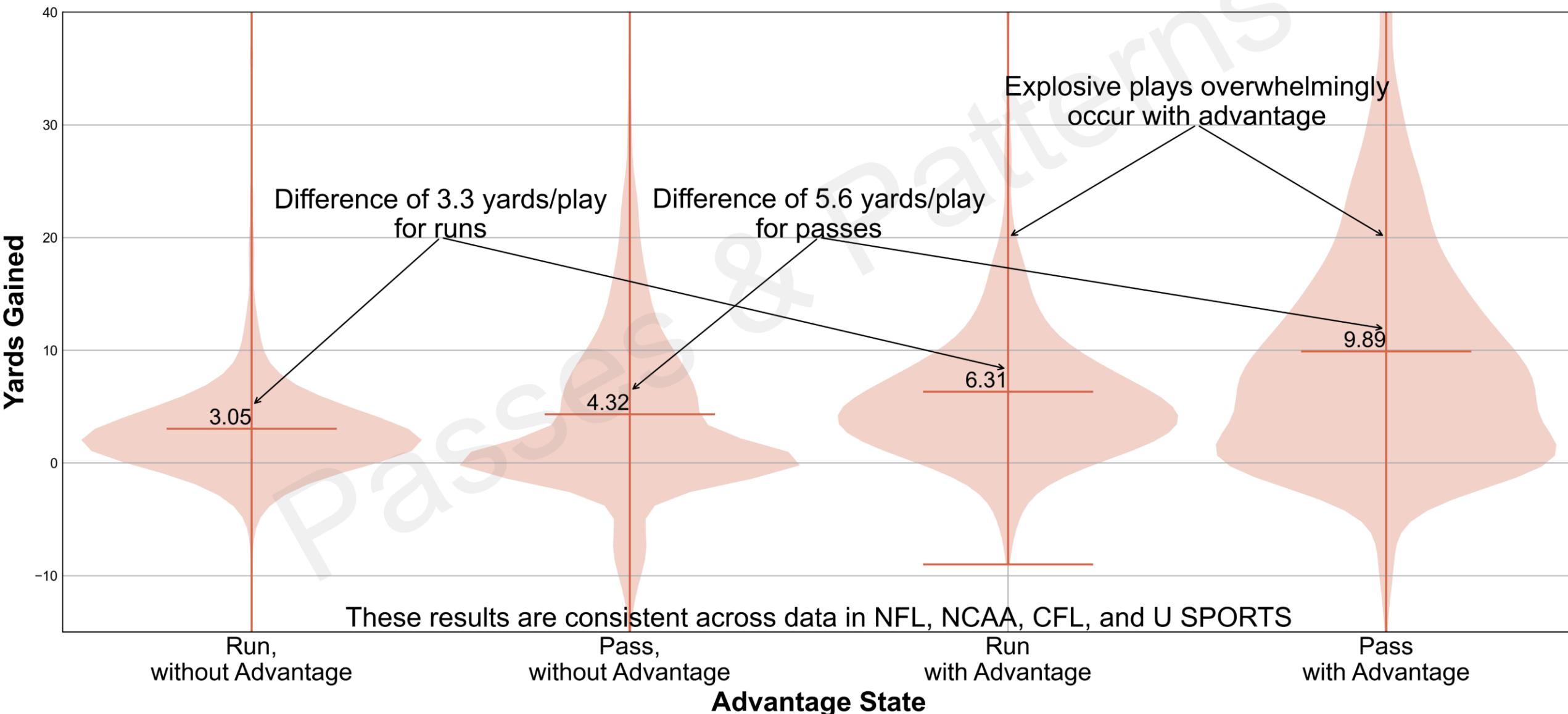
Advantage Doubles Yards per Play



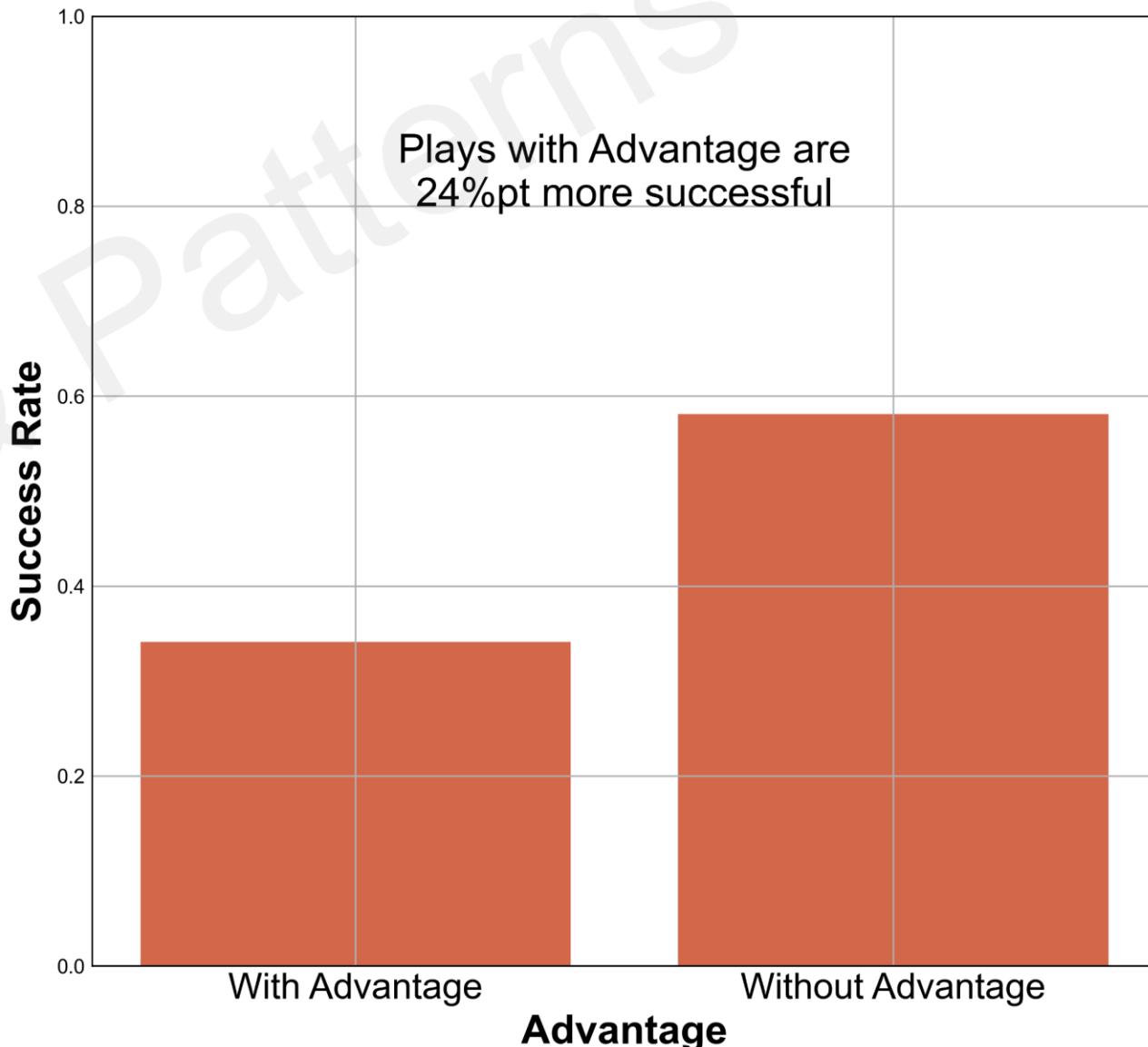
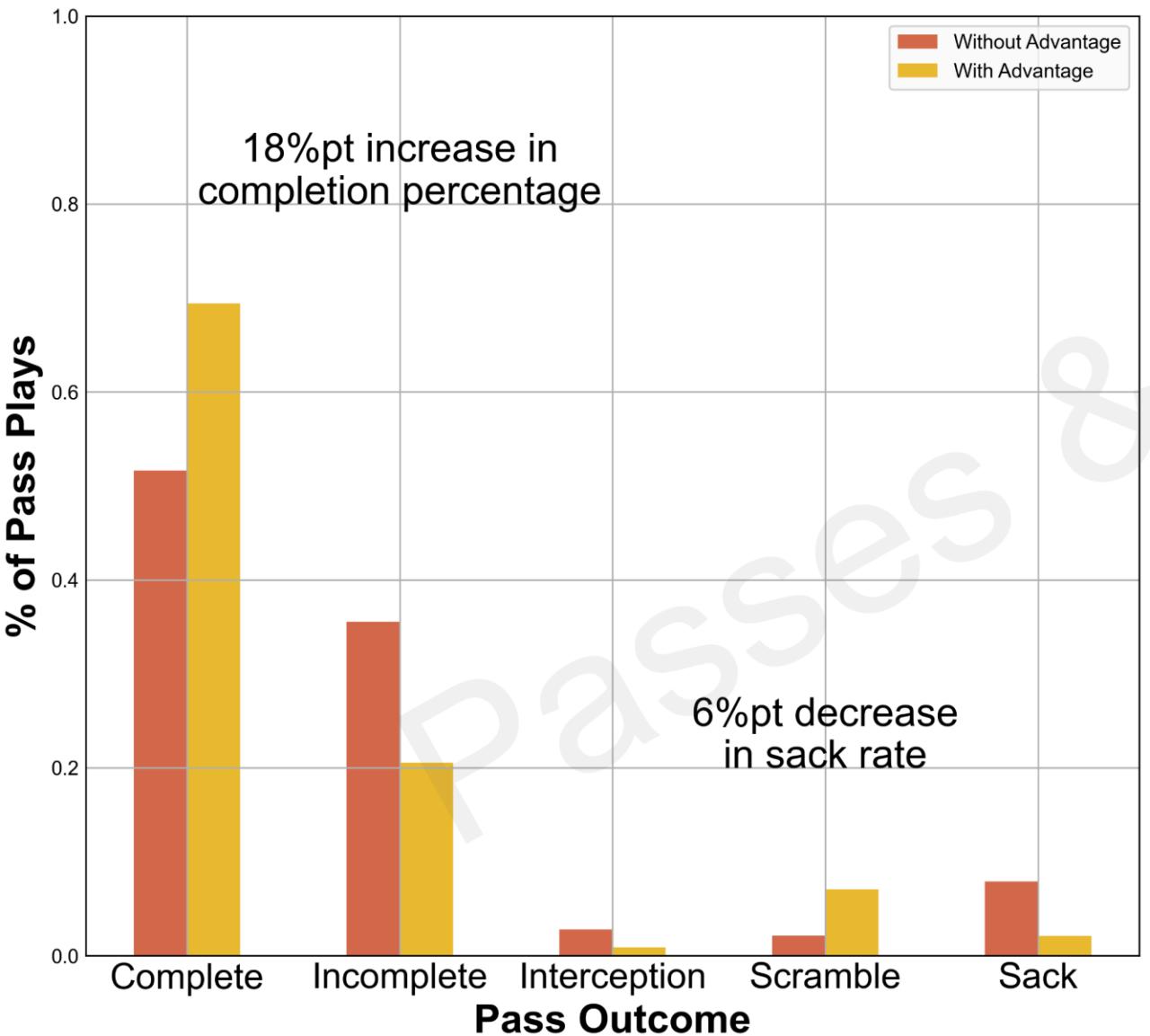
Advantage is Worth Half a Point per Play



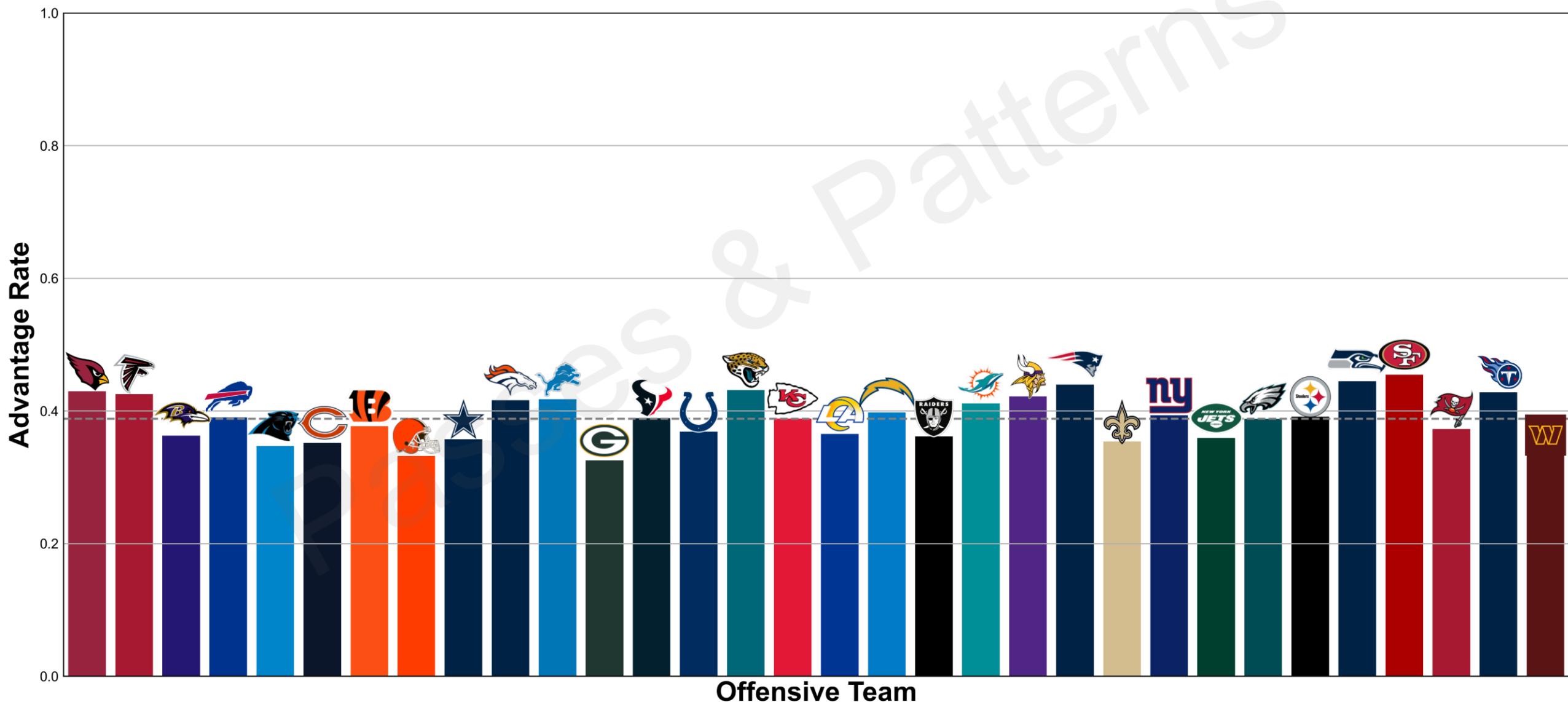
Advantage Doubles Yards per Play For Both Run & Pass



The Impact of Advantage, Continued



NFL Teams Only Attack With Advantage on 39% of Plays



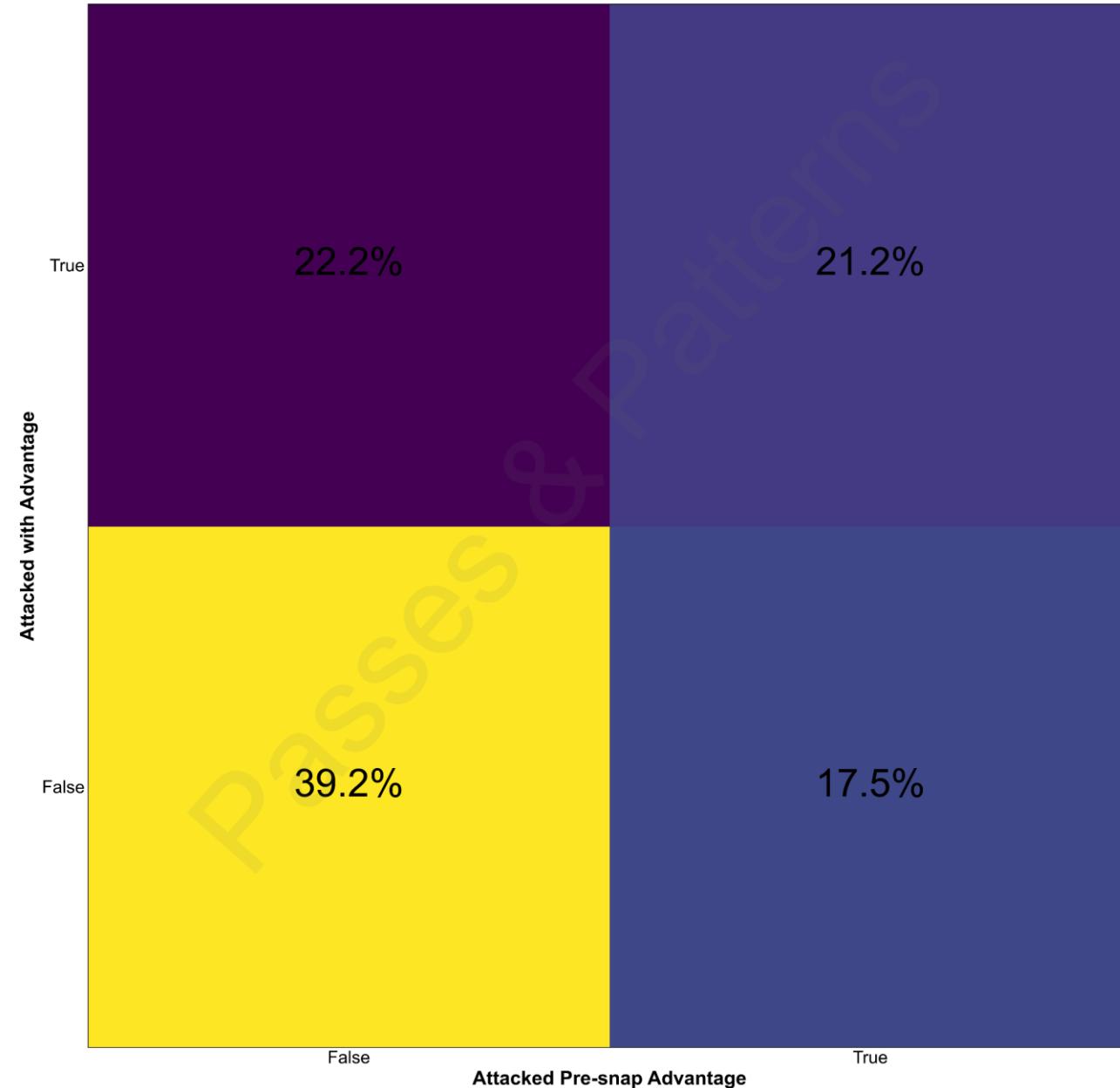
Pre-Snap Advantage is a poor indicator

Pre-snap advantage in a field zone is a weak predictor of advantage at the moment of attack

Teams attack field zones showing advantage pre-snap only 38% of plays

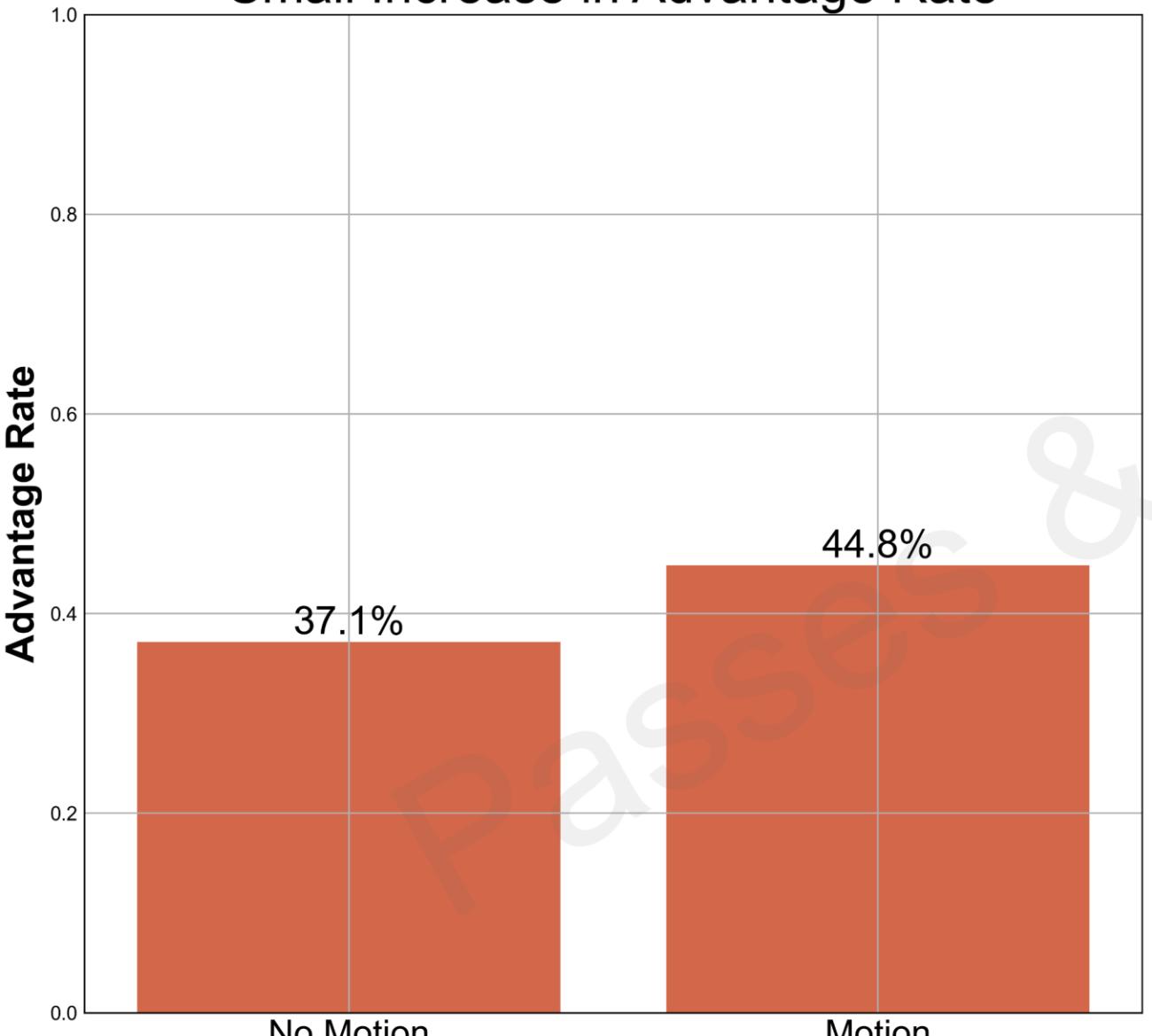
Even when attacking pre-snap advantage the advantage rate at the moment of attack was only 55%

Attacking Pre-snap Advantage Helps,
But Only a Little

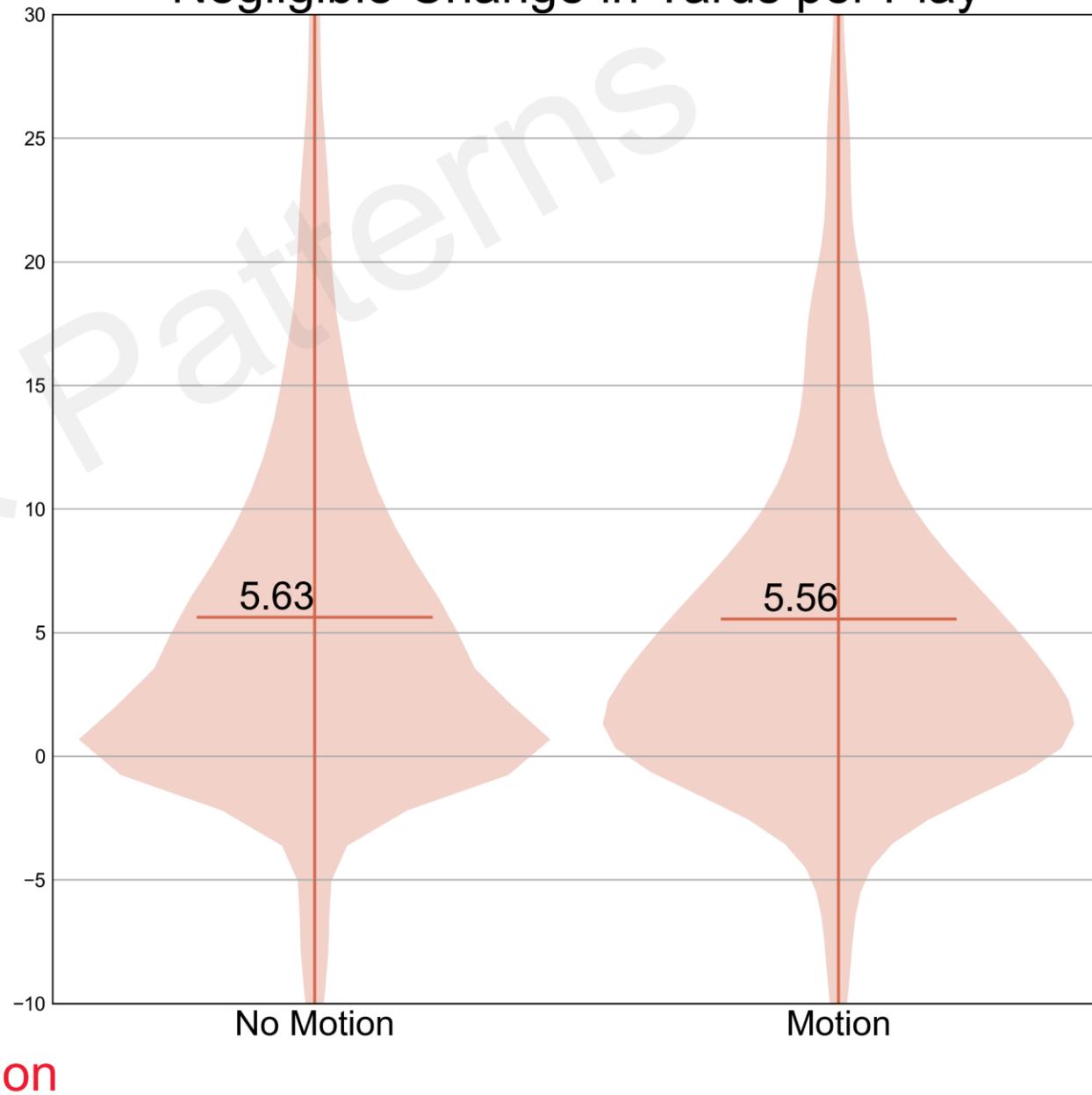


Motion is Overrated

Small Increase in Advantage Rate



Negligible Change in Yards per Play



Why is Pre-snap not Enough

Both offensive and defensive players can move between field zones pre-snap as well as post-snap

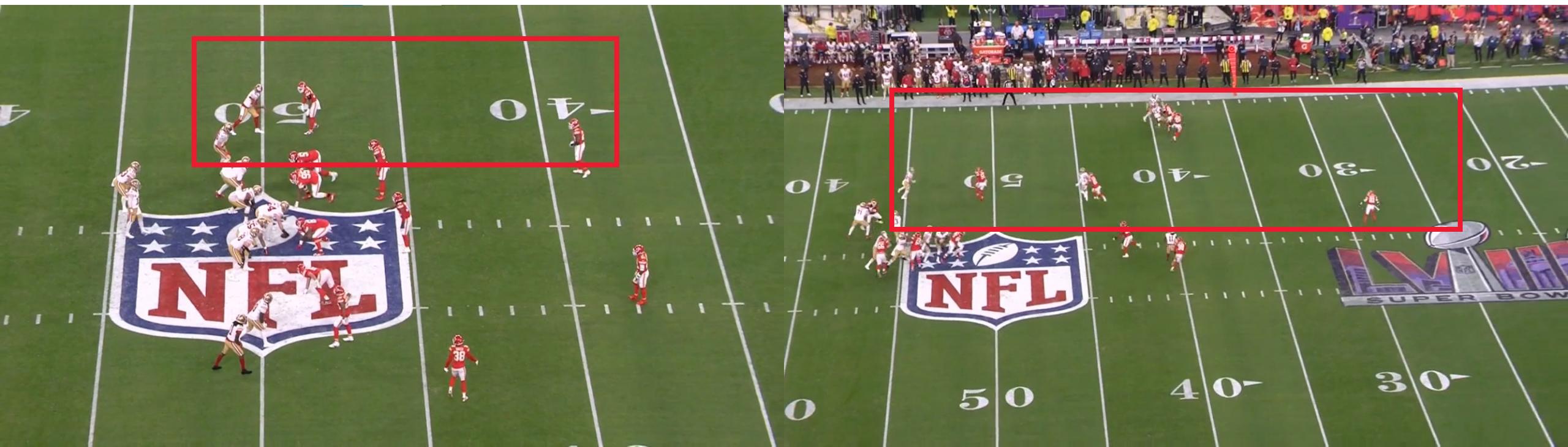
Effective advantage-aware schemes need to control for defender movements

Advantageous formations limit a defense's ability to align ambiguously, *disadvantageous* formations

Players Move

Pre-snap shows advantage to the field with 2 receivers and 2 defenders

Post-snap there are now 4 receivers and 5 defenders



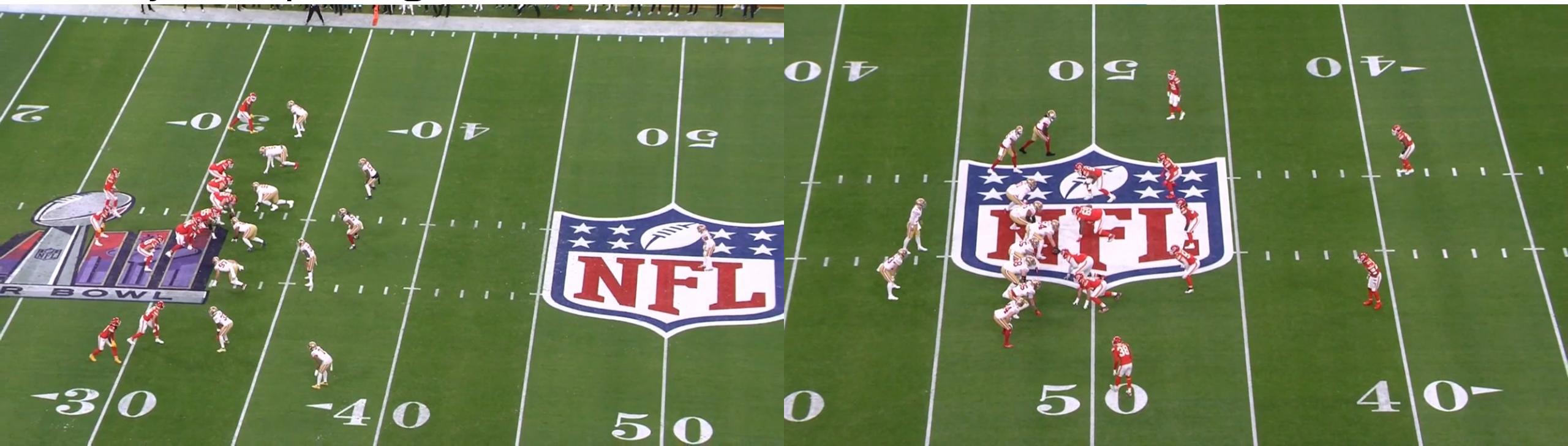
Advantageous Formations

Advantageous formation

The defense's ability to align players ambiguously is limited by the spacing

Disadvantageous formation

Multiple defenders with ambiguous alignments



Impact of Advantage

Plays with advantage gain an extra 4.5 yds, or 0.65 EPA

On-field experience shows advantage rate can reach 80%.
This allows for short yardage, long yardage, and end of half.

At the current league average of 39% there is a potential net gain of 1.8 yds/play or 0.27 EPA/P

For comparison:

Passing vs. rushing is worth 0.05 EPA/P, with diminishing returns

4th down decisions are worth 2-3 points per game

Difference between #1 and #32 offence: 2.1 yards/play

Challenges of Implementation

While claiming that one's offense attacks with numbers is an article of faith among coaches, the NFL average of 39% falls well below our experientially derived target of 80%.

Implementation presents an ontological crisis. What must change is not the schemes themselves, but the intellectual framework that surrounds them.

Implementation Process

Top-down understanding of the foundations of advantage theory

Robust methods to effectively identify convert pre-snap reads into post-snap advantage

Formations that force defenders to declare themselves

Concepts that can efficiently attack all three field zones

Clear decision trees to correctly identify and attack advantageous field zones

Conclusion

Value of attacking with advantage:

4.5 yards/play

0.65 EPA/play

NFL operating at 39% overall – 80% is achievable

0.26 EPA/P overall net gain to be had

Pre-snap data is insufficient to optimize advantage rate

Implementation requires paradigmatic change

<https://github.com/christophermclement/NFL-BDB-VII>