“Stomping” Out Fielder Pitch Tipping

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Abstract:
In this paper, we examine how defensive positional players may unintentionally ‘tip’ the pitch type through their field positioning and early movement before the pitch is delivered. Using 2-D player-tracking and 3-D ball tracking data from across 2 MiLB seasons provided by SMT, we first classified pitches as fastball or offspeed with glove- or arm-side run. After accounting for pitcher- and batter-handedness, we then used logistic regression models and plots faceted by pitch type and team to conclude which positions and teams had pre-pitch movement patterns that correlated most strongly with pitch type.

Introduction:

It's May 30, 2022; Adam Duvall is hitting for the Braves against Zac Gallen of the Diamondbacks. The 1-1 pitch is a curveball, inside. Duvall pulls it on the ground towards third baseman Josh Rojas; Rojas slides to smother the ball and has no play at first; it's an infield single.

The play is more interesting if you instead watch Geraldo Perdomo, the Diamondbacks shortstop. Notice that at the frame the broadcast switches away from the batter's box, Rojas is just finishing up his first step. Perdomo, on the other hand, is already in full sprint.

Figure 1a (left) – Rojas and Perdomo chasing after a ground ball (Video)

Figure 1b (right) - Perdomo diving (Video)

As Rojas scoops up the ball, Perdomo is diving behind him in a perfect position to stop the ball himself. This is a third baseman's ball, and Perdomo has no business being this close to making the play himself.

How did Perdomo put himself in such a good position to make this play? He answers this in an interview the next day - he was already moving toward third base before the pitch was hit, having guessed that an inside curveball to a righty would be pulled. Consider, though, that if Perdomo moved because he knew what pitch was coming, couldn't Duvall have seen him moving, deduced why, and thus known the pitch coming himself? (Mackie 2022).

There isn't much existing research on fielders tipping pitches. These fears are usually limited to pitchers, who may hold their glove higher or at a different angle from one pitch type to another, allowing batters to pick up on this and know what's coming. However, even before PitchCom gave fielders a direct link to the pitch call, the middle infielders could see the catcher's signs and

pass them on to the rest of the defense. At first thought, this is an advantage for fielders, who may be inclined to cheat a few steps towards the hitter's opposite field if they know the pitch is a fastball and the batter is likely to swing late. On the other hand, if the fielders are overzealous with their pre-pitch movement, batters can pick up on these trends in the same way they do a pitcher's tip.

Perdomo's Diamondbacks are paying attention to this more than perhaps any other team; manager Torey Lovullo coined the term "stomping" to refer to middle infielders tipping pitches. They run spring training drills to avoid "stomping" and even keep a "list" of the most obvious "stompers," claiming that it provides results. Per Luvollo, "I'll hear hitters say they stayed on that pitch because they saw the second baseman move" (Mackie 2022).

Given the lack of research in this area and the substantial effect it could have/already has on the game, we sought to examine whether pitch types could truly be predicted by player movement.

Data:

The provided dataset consisted of player and ball-tracking data on over 300,000 pitches spanning two MiLB seasons at a single level. Three "consistent" teams were longitudinally tracked throughout the dataset, and all opposing teams were anonymized on a series-wide basis. Teams other than the "consistent" teams did not have a high sample size. The data is from before recent rule changes, such as shift bans and PitchCom usage, were introduced in the minors.

Many basic facts about plays had to be reverse-engineered from the player-tracking data. We determined batter handedness by using the position the batter stood in 3 seconds before the pitch release. This meant we classified batter handedness on a pitch-by-pitch level, rather than establishing a batter hit righty, lefty, or both and using that for all of their appearances.

We also calculated pitcher handedness: inferring handedness from which side of the rubber pitchers released their pitches from, given that lefties primarily release from the right (field) side of the rubber and righties primarily release from the left (field) side. Due to inconsistencies we found in the data, we filtered the dataset to just the "consistent" teams and accepted a pitcher as being of a certain hand if at least 80% of their pitches were thrown from a certain side. Pitchers whose handedness could not be verified in this way were also removed.

Pitch type was not provided in the dataset, so we built a pitch classifier algorithm to estimate it ourselves. To differentiate similar pitch types as Statcast does (e.g., curveball vs slider) would be impossible/unreliable since the dataset only provides around 10 locations of the ball during each pitch. Instead, we separated the data into fastballs, glove-side offspeed (titled “breaking”), and arm-side offspeed (titled “offspeed”).

We calculated two primary characteristics for each pitch: velocity and horizontal break. Velocity was calculated by finding the distance the ball travelled between the first timestamp available (its location at pitch release) and the next timestamp, 50 ms later. We considered a pitch to be a fastball if it was at least 90% of the pitcher’s maximum velocity; we tested out several thresholds for this, but this produced results in line with minor league fastball percentages according to Statcast [1]. Arm-side and glove-side offspeed pitches were classified based on the following formula:

> If the direction of horizontal movement matches the pitcher’s hand (RHP with negative movement or LHP with positive movement), classify it as arm-side offspeed. Otherwise, classify as glove-side offspeed.

Ultimately, this did not catch as many arm-side offspeed pitches as there should have been, so while we kept this distinction in our visuals, we combined both forms of offspeed into one for our statistical tests.

Feature Engineering

We calculated a metric for distance traveled pre-pitch that we called “pre_pitch_delta” for every fielder for every pitch, as the difference in fielder position between the first timestamp of player tracking available (three seconds before the pitch release) and the timestamp of the pitch release. Due to how computationally intensive working with the full dataset was, we filtered the rest of our analysis to pitches where a fielder moved at least five feet in these three seconds.

For our analysis, we converted the x and y coordinates of the field to polar coordinates, expressing fielders’ positions in terms of the distance to home plate and their angle for the horizontal line going through home plate, where the right foul line is 45 degrees and the left foul line is 135°. These numbers still describe the position of the player on the field, but map better to a baseball field. Player movement is now measured as a change in these terms.

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[1] Around 55% of tracked AAA pitches in 2025 were fastballs (4-seam, sinker, or cutter) as of July 30 (per Statcast)

After applying the 5 ft pre-pitch movement minimum qualifier, approximately 11k data points remained where we had the proper data for pitcher and batter handedness.

We grouped the remaining plays by the position of the defender who moved, and the handedness of the pitcher and batter involved.

Modeling

We created logistic regression models to predict whether or not a pitch on which a fielder moved significantly would be offspeed based solely on

- The depth of the fielder 3 seconds before the pitch
- The angle of the fielder from home plate, 3 seconds before the pitch (which establishes how far they were playing left to right)
- The change in depth from 3 seconds before the pitch release to the release
- The change in angle from 3 seconds before the pitch release to the release

All data was scaled and centered around 0 before the regression was applied.

Intuition/Expectations - What would pitch tipping look like?

A hitter is generally more likely to be late on a fastball than an offspeed pitch, so we would expect fielders to cheat over towards the hitter's opposite field if they are acting on their knowledge of a fastball, and towards the hitter's pull side in the case of offspeed pitches. First and third basemen, as well as left and right fielders, might be tempted to stay closer to the foul lines depending on the hitter's handedness and the pitch type.

Covering the steal would influence positioning and movement for middle infielders, too. For certain managers, the decision on who covers comes down to the pitch type; a second baseman might cover against righties on breaking balls, but on a fastball, he might stay in position and let the shortstop cover. Similarly, with a lefty hitter at the plate, a shortstop might be less likely to cover the steal on a fastball.

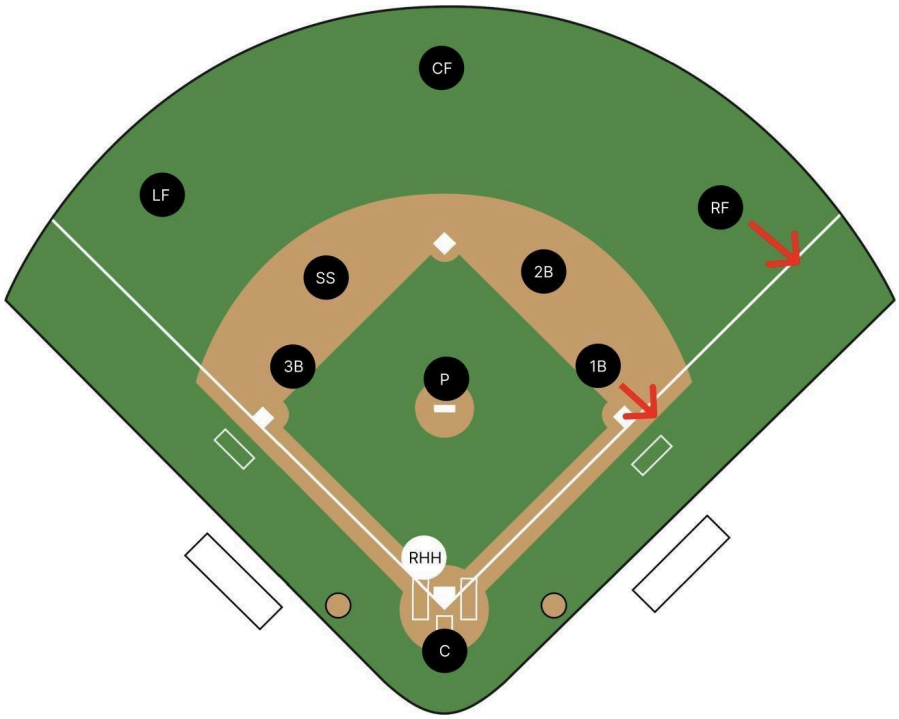


Figure 1c (above) – If a right-hand batter is late on a swing, the 1B and RF have reason to shift to the right

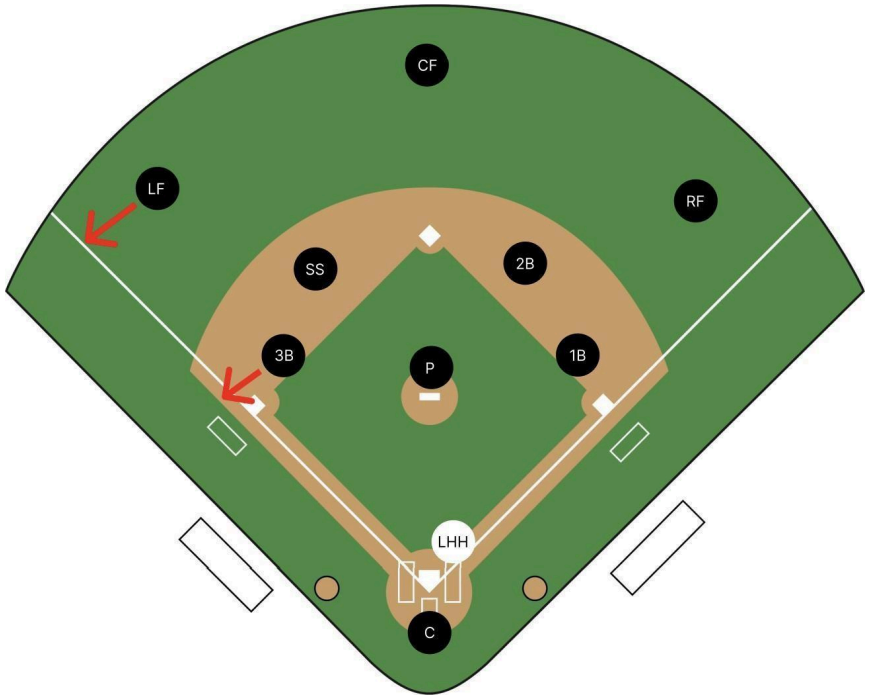


Figure 1d (above): If a left-handed batter is late on a swing, the 3B and RF have reason to shift to the left

Results

Our findings suggest there is a real link between fielder positioning/motion and pitch type. The visuals included in the visuals section below are of statistically significant effects that matched our expectations.

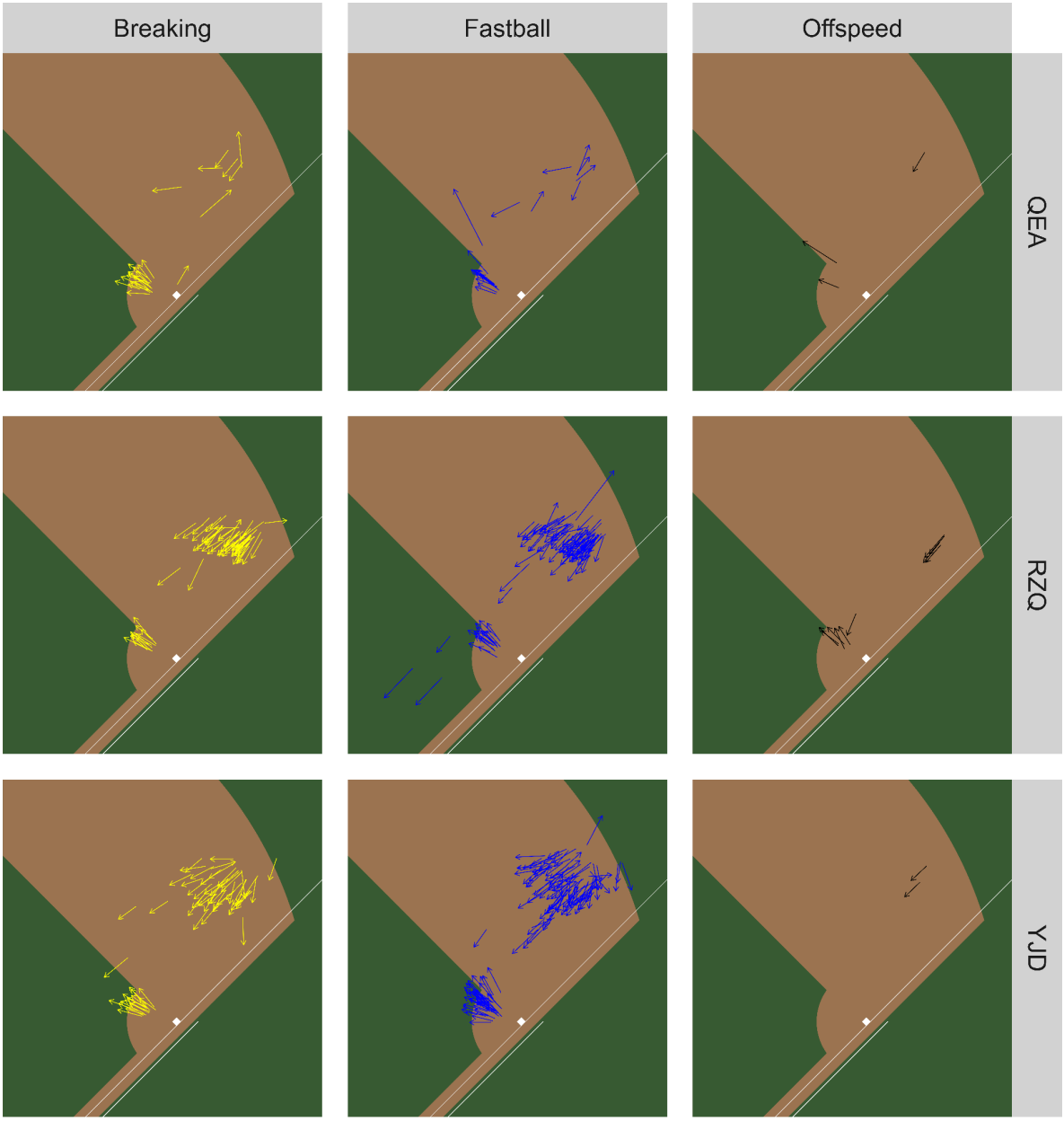
We ran 112 statistical tests with a threshold of $p < 0.05$, and 13 came back as significant. The chance of all of these being false positives is about 4.56% which is statistically significant by the 0.05 threshold, suggesting that at least some of the observed effects of fielder movements and positioning on pitch type are real.

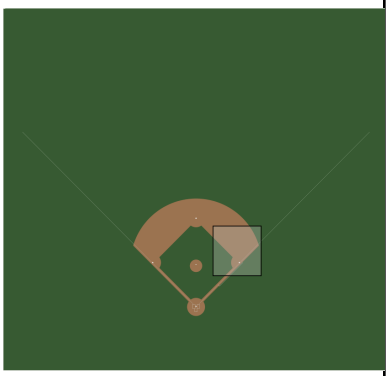
The 112 tests come from modeling the effect of our four variables on pitch type for the four combinations of batter and pitcher handedness, for the seven infield and outfield positions (excluding pitcher and catcher). Of the 13 statistically significant effects found, 6 line up with the "intuition" above of why fielders would move before the pitch, 4 go against this intuition, and 3 don't have a clear reason for their movement (but are still promising as tells).

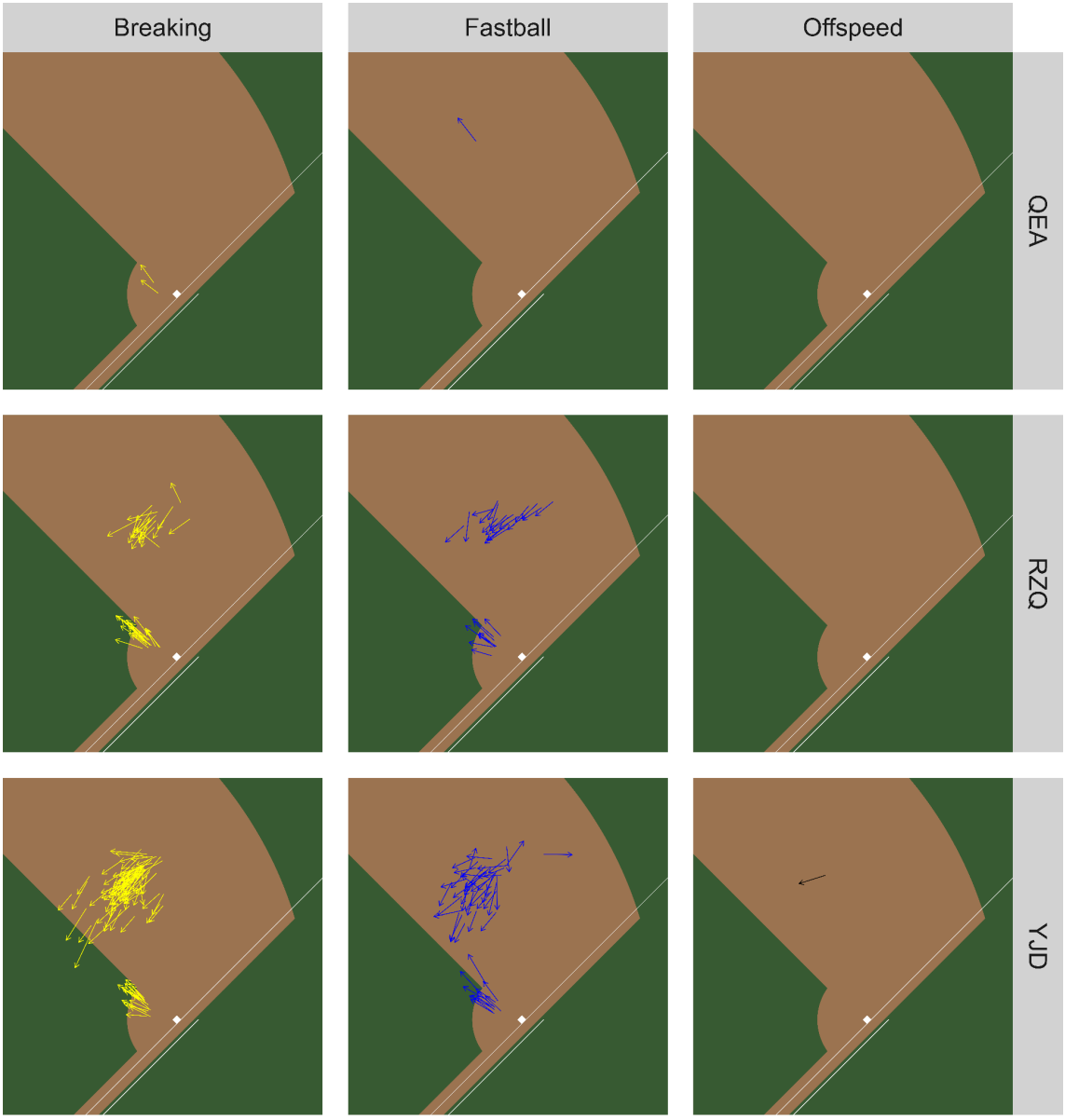
Some of the effects found are large enough to be exploited by hitters - if a scouting team finds that a team's third baseman tends to take a step backwards on offspeed pitches to righties, batters can be told to watch for this. On the other side, a team might be able to catch themselves tipping in this manner and correct themselves before their opponents catch on.

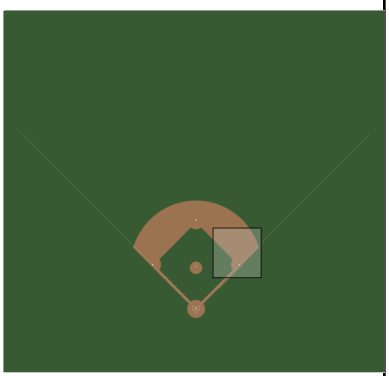
This is an understudied area of research, and the effects at the college and professional levels could be exacerbated by the use of the PitchCom device, which can grant any three fielders knowledge of the pitch type (typically the 2B, SS, and CF, but other arrangements are possible).

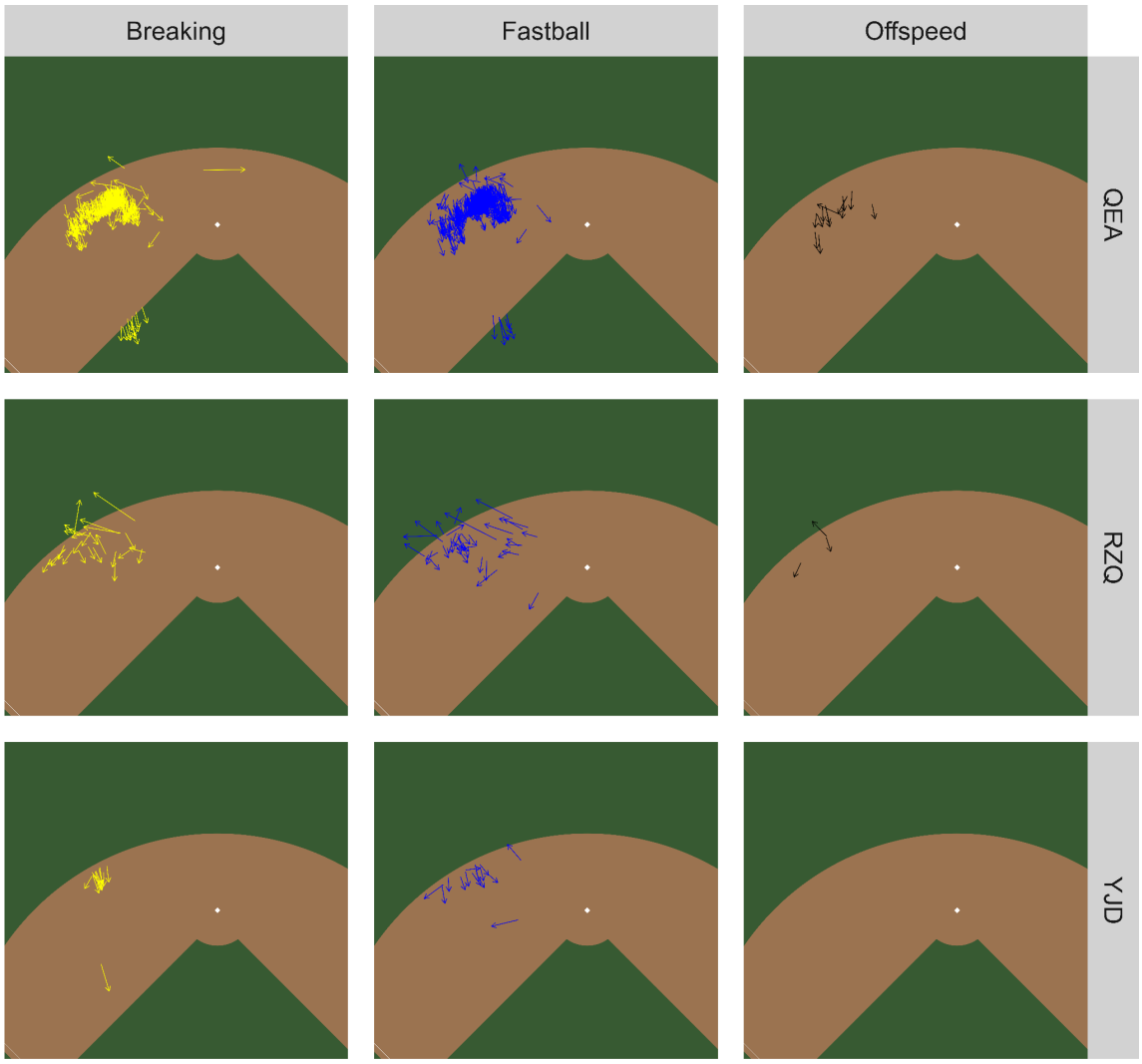
Below are our observed effects, with additional observed effects listed in the appendix.

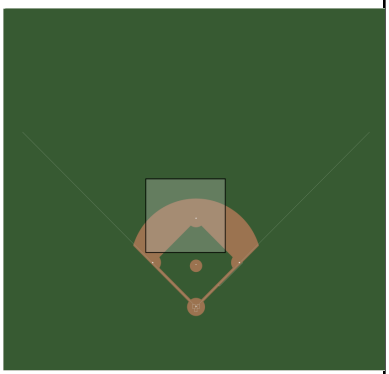


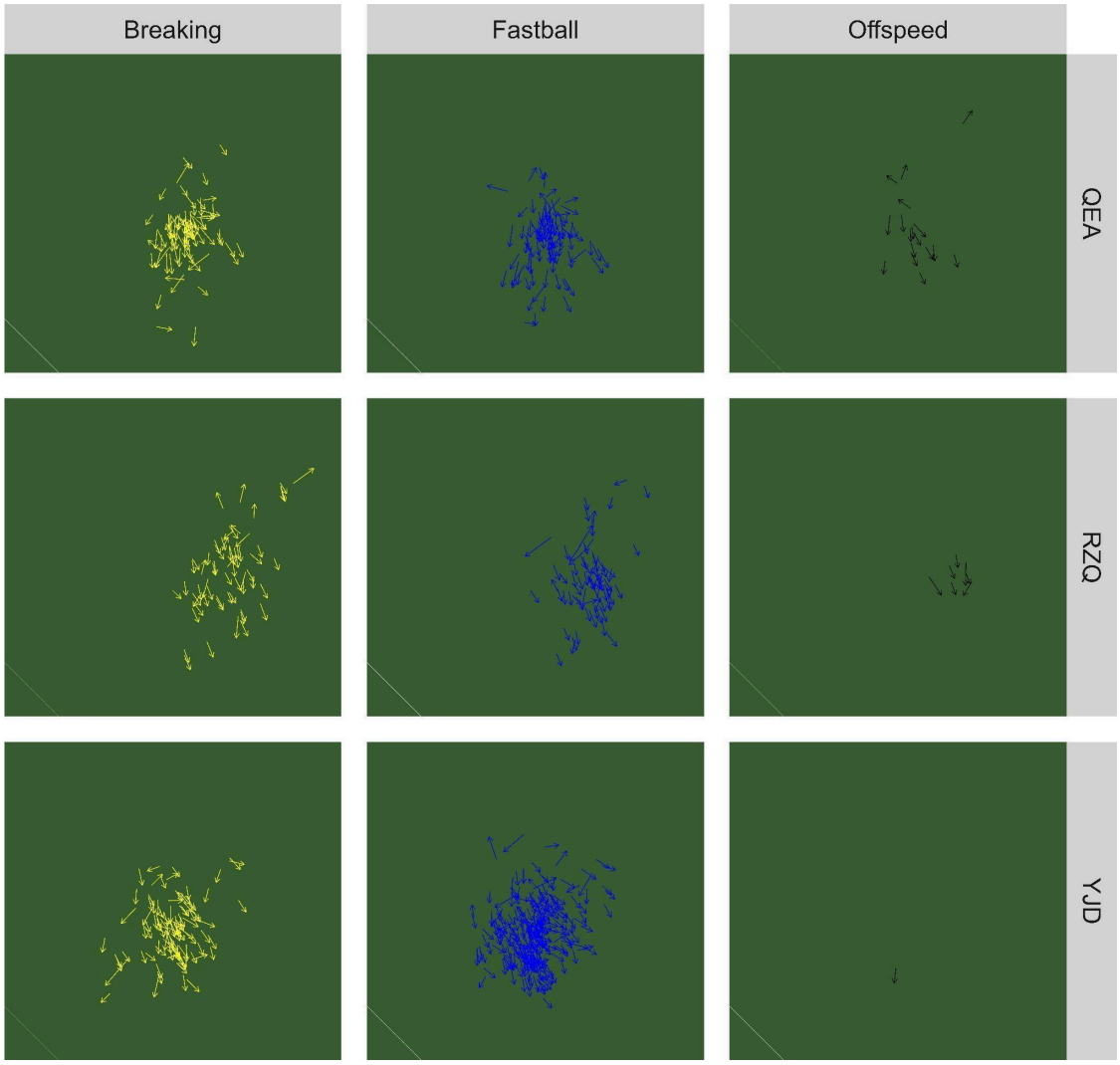
Who: First Baseman **When** RHP vs LHH **Magnitude** T1: margin = -0.09323, p = 0.0106 **Sample Size** 421 plays	**How** Playing closer to the line/bag correlates with more offspeed pitches, and playing further from the line correlates with more fastballs. **Why** *Matches Intuition* First basemen would want to cheat towards the opposite field against fastballs.	**Viewing Area** 

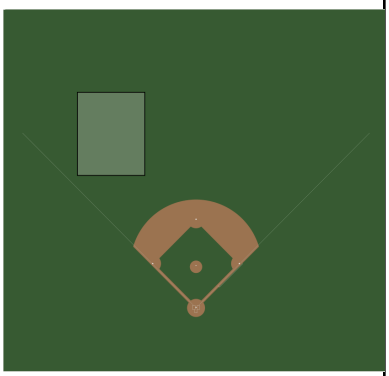


Who: First Baseman **When** LHP vs RHH **Magnitude** R_delta: margin = -0.1539, p = 0.014127 theta_delta, margin=0.1471, p = 0.022623 **Sample Size** 224 plays	**How** Moving further away from the bag correlates with more offspeed. Also, moving in towards the plate correlates with more offspeed. **Why** *Matches Intuition* First basemen would want to cheat towards the opposite field against fastballs. Their creeping further in suggests they expect weaker contact as well, since they expect the batter to swing late.	**Viewing Area** 



Who: Shortstop **When** RHP vs RHH **Magnitude** theta_delta: margin = 0.07341, p = 0.00242 t1: margin = 0.04118, p = 0.03288 **Sample Size** 753 plays	**How** Moving more towards the left ahead of the pitch corresponds with more offspeed, as does standing further to the left. **Why** *Matches Intuition* Shortstops would want to stay closer to the opposite field on a fastball	**Viewing Area** 



Who: Left Field **When** RHP vs LHH **Magnitude** T1: margin=-0.07217, p = 7.38e-05 **Sample Size** 721 plays	**How** Playing closer to the left foul line correlates with less offspeed **Why** *Matches Intuition* Left Fielders would cheat towards the opposite field on fastballs	**Viewing Area** 

References

Baseball Savant

- Lefties with negative horizontal release
- Righties with positive horizontal release
- Frequency of MILB pitch types
- Video of Perdomo Play

AZ Central Interview of Torey Luvollo and Geraldo Perdomo

Intuition on infielder movements:

Wally Backman Baseball Tutorial: Middle Infield Signals

Infield Positioning on the Pitch - Baseball By the Yard

R packages: tidyverse, arrow, gganimate, sportyr, margins

SMT - Provider of data

Thanks to Meredith Wills and Billy Fryer of SMT for invaluable help throughout the development of this paper, including reviewing earlier drafts

Appendix A: Discussion

Several factors affect our idea and (eventually) affect our findings. Some of these factors are:

1) Batter Tendencies vs Pitch Prediction:

   One primary challenge is unwrapping whether pre-pitch fielder movement is due to expected pitch or expected contact. Pre-game scouting reports of batter tendencies, such as pulling inside, may influence defensive shifts for a few select fielders. Therefore, what may appear as a reaction to a pitch type may be a pre-determined plan to maximise defense against a select batter?
2) Pitcher arsenal:

   Pitchers who have only a few select pitch types in their arsenal might show stronger movement signals, but they might be due to a strategy discussed pre-game rather than real-time cues. (Add an inference with an example of a specific pitcher)
3) Data Noise:

   This tracking data had some inconsistencies. We noticed duplicated position rows, inconsistent fielder locations, duplicate play_ids, etc. Specifically, outfielder movements were very sensitive at times. Such inconsistencies bothered our processes, and we had to remove any such data before proceeding to the next step.
4) Strategy:

   As pitch tipping becomes a threat, the coaching staff may actively be strategizing to minimize or randomize fielder movements. Infielders may be asked to shift only after a pitcher begins his windup (forcing the batter to focus on the pitch) or hold a default

   position throughout the game. This weakens the power of our inferences, and as our data might already have such movements as part of a team's strategy.
5) Special play types: Other pre-pitch movements that we considered are the third basemen charging in for a bunt and the first basemen holding runners on at first base.

Appendix B: Limitations

1) Include all pitches in statistical tests rather than just those with 5 feet of movement.
   a) This means that our analysis is more about whether fielders move 5 vs 7 feet, not whether they move 5 feet at all. This means that the effects we find are on the scale of a step or two extra in one direction. That said, these are the effects of fielder-based tipping that seemed most plausible to begin with; a fielder staying in place on a fastball but shifting ten feet on offspeed pitches would be very obvious, but taking an extra step on a usual pre-pitch movement is a more subtle tell, which we seem to have caught.

2) Calculating launch angle and exit velocity of pitches where a batter made contact, and testing whether better contact was made when fielders moved in a particular direction (i.e., did batters pick up on this tipping and gain from it)

3) We don't consider the position where the catcher sets up, but whether a pitch is inside or outside plays a big part in whether the batter pulls it or not, and so this could be another thing fielders "cheat" off of (in fact Perdomo states in the interview we mention that he cares more about the pitch location for deciding where to move)

   a) Catcher positioning can also be a tell as to where the pitch is coming, but this movement is much less than 5 feet,t it isn't included in our analysis.

4) The pitches thrown by lefties in the constructed dataset of ~11k pitches skew heavily towards offspeed, which suggests that there is some selection bias in this dataset; lefty fastballs were more likely than righty fastballs to be filtered out (for some reason).

Appendix C: Data errors

We discovered that the SMT data contained several strange sequences where a pitcher's horizontal release would switch between 2+ feet to the left of the rubber and 2+ feet to the right of it, a much higher percentage of pitching from their non-dominant side of the rubber than one would expect. Due to this presumed data error, we removed all pitchers that were not from the three consistent teams (due to their low sample size). All pitchers who supposedly released more than 20% of their pitches from their non-dominant side were also removed, given the rarity of switch-pitchers. All remaining pitchers were assumed to be righty or lefty based on their most common release side, as explained above, and pitches were classified as having arm- or glove-side run based on the pitcher's determined handedness.

1) Batter handedness: Similar to pitchers, this method led to many batters appearing to be switch hitters, having taken 50 pitches as a righty and 3 as a lefty, or something similar. However, we did not filter out these unusual data points because, unlike pitchers, switch hitters are a common occurrence in baseball.

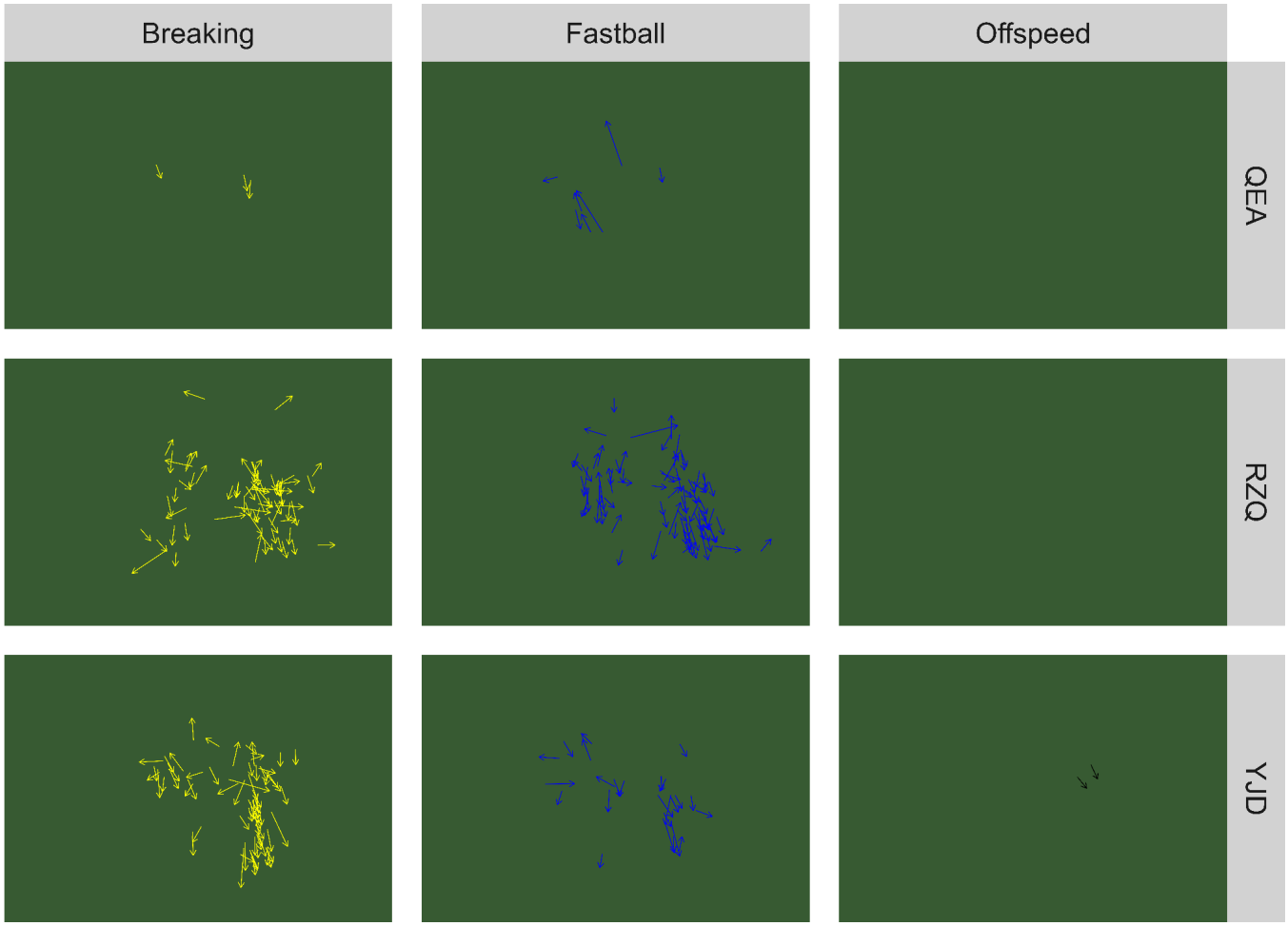
2) Another issue we encountered in the data was plays that had several sets of players assigned to each position, e.g., there existed a row where the same player was playing shortstop, pitcher, and right field on the same pitch. Since this was incorrect, we filtered out any data with these issues, too.

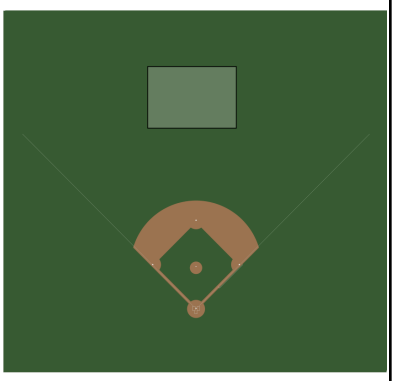
Appendix D: Pitcher Handedness

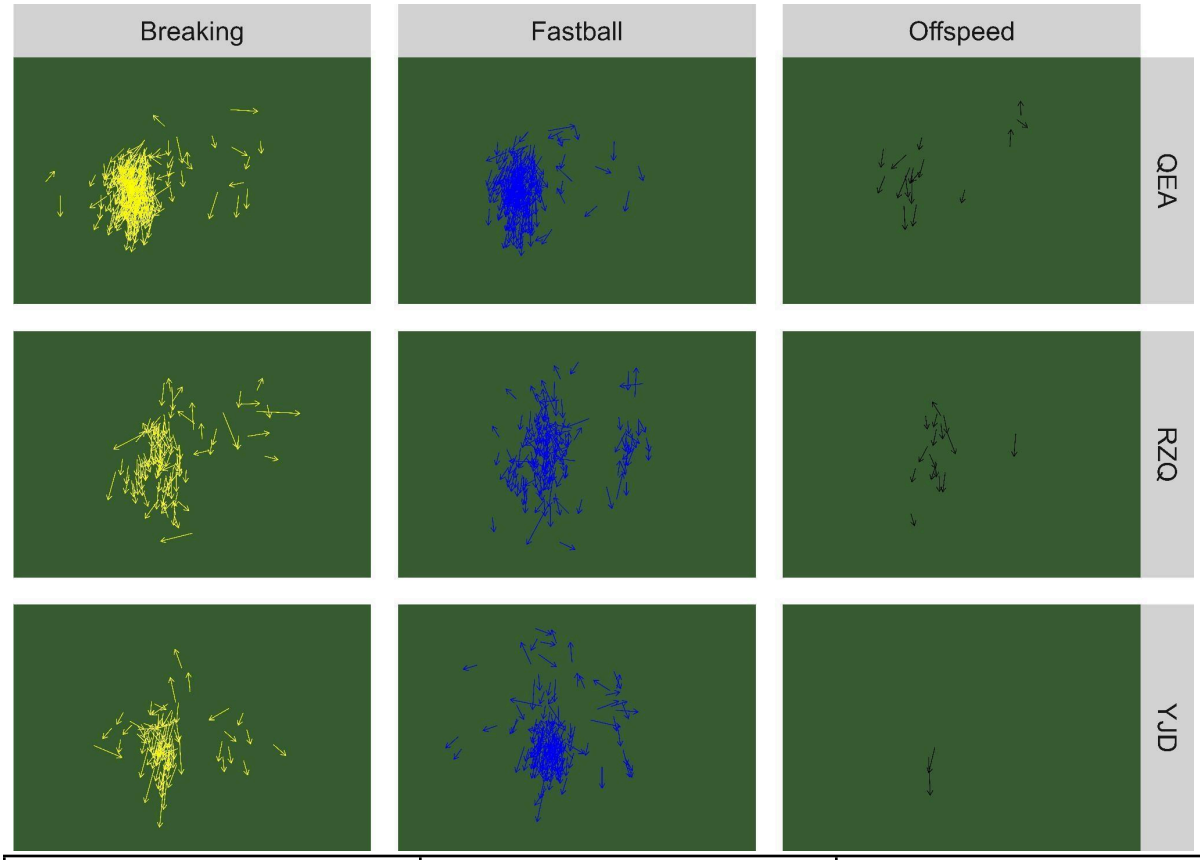
Player	Pitch %
Ramirez, Emmanuel RHP	70.1
Devenski, Chris RHP	47.8
Plesac, Zach RHP	26.4
Flexen, Chris RHP	14.7
Helsley, Ryan RHP	7.9
Fairbanks, Pete RHP	7.5
Megill, Trevor RHP	4.3

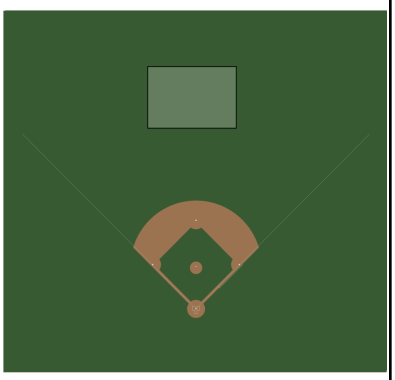
Player	Pitch %
Coulombe, Danny LHP	100.0
Peralta, Wandy LHP	10.3
Thielbar, Caleb LHP	6.1
Cantillo, Joey LHP	2.8
Bauers, Jake LHP	1.3
Chapman, Aroldis LHP	1.0
Williamson, Brandon LHP	0.8
Valdez, Framber LHP	0.1

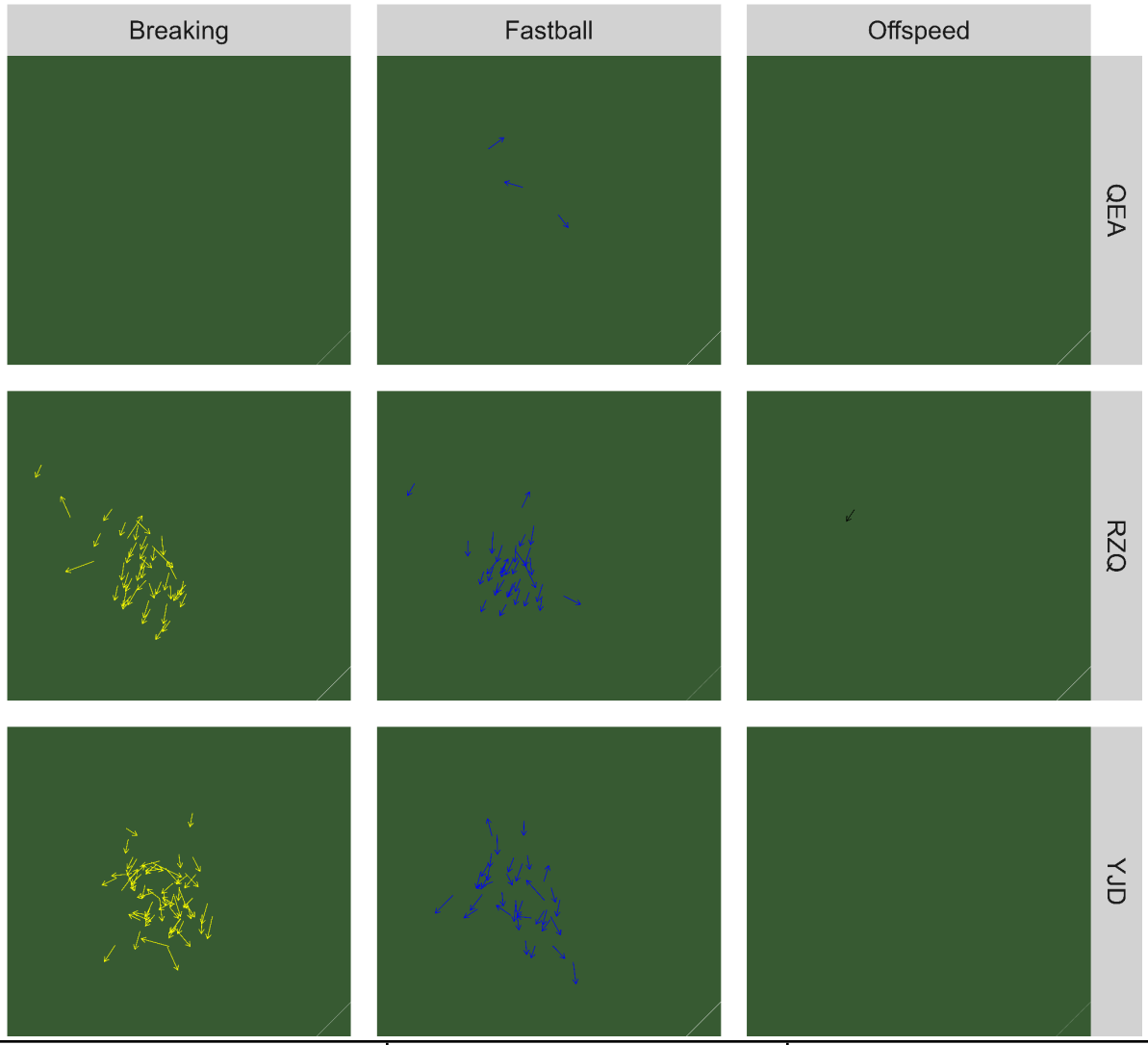
Per Statcast data, 634 righties threw a pitch during the 2024 season, yet only 6 threw more than 4% of those with a positive horizontal release point (i.e., left of the center of the rubber). Meanwhile, 3 lefties out of 221 total threw over 4% of their pitches with a negative release point. That’s barely 1% going against the standard, so it's reasonable to accept this metric as pitcher handedness and extrapolate this from the majors to the minors.

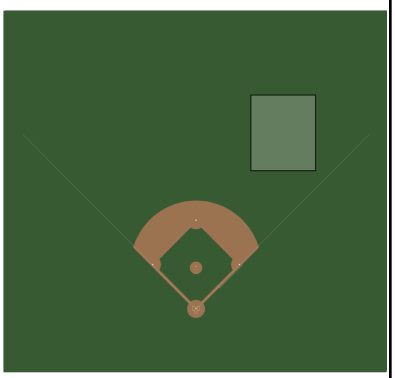


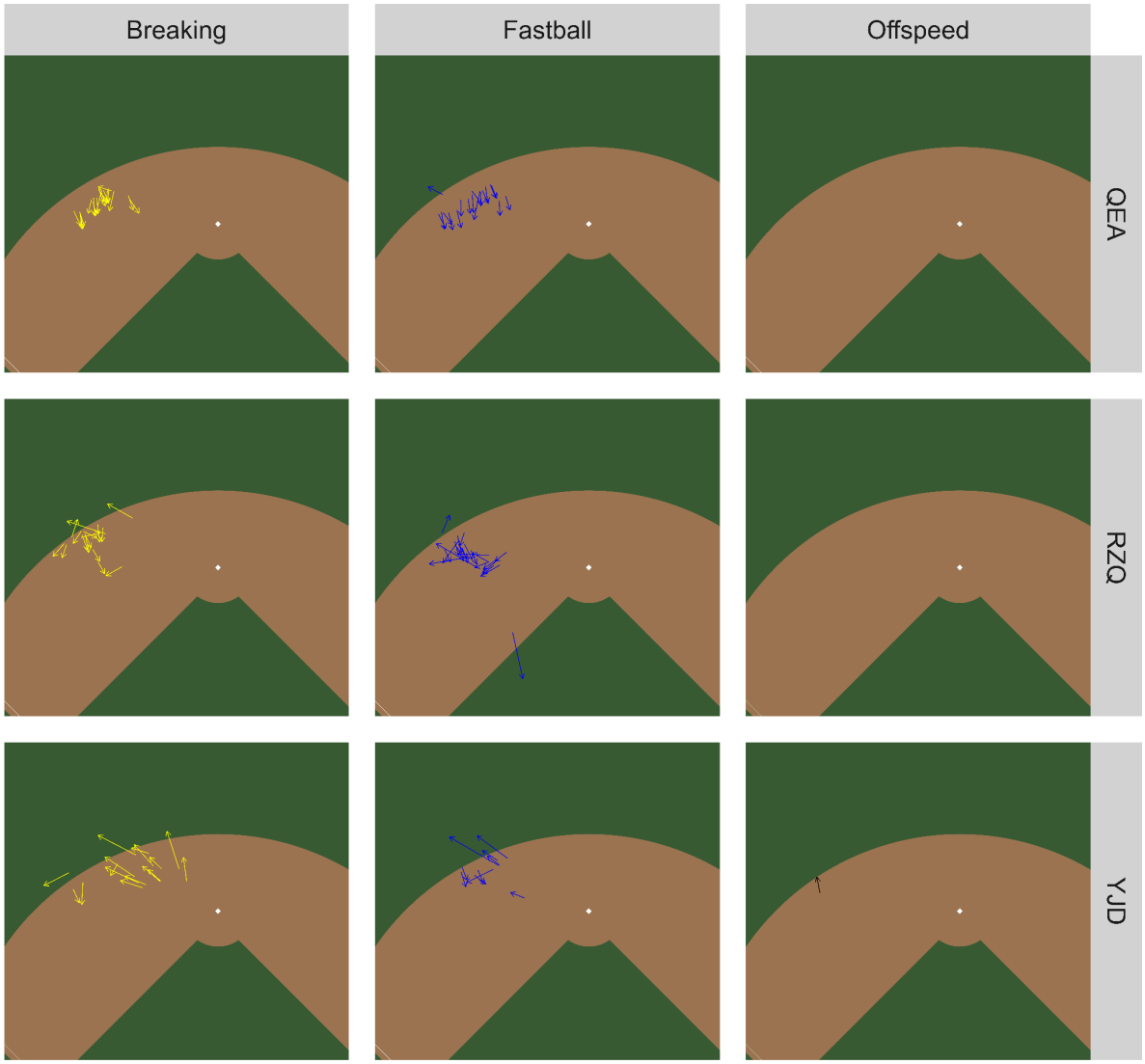
Who: Center Field **When** RHP vs RHH **Magnitude** r_delta: margin = -0.03743, p = 0.0300 t1: margin = -0.0338, p = 0.0424 **Sample Size** 939 plays	**How** Playing closer to left field corresponds with less offspeed. Moving deeper before the pitch corresponds with less offspeed. **Why** *Opposes Intuition:* A center fielder would presumably want to play closer to the opposite field on fastballs, but here they are doing the opposite. *Agnostic to Intuition:* It's unclear whether a deeper outfield would be better for certain pitch types.	**Viewing Area** 

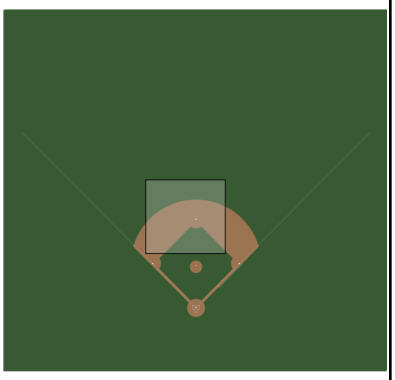


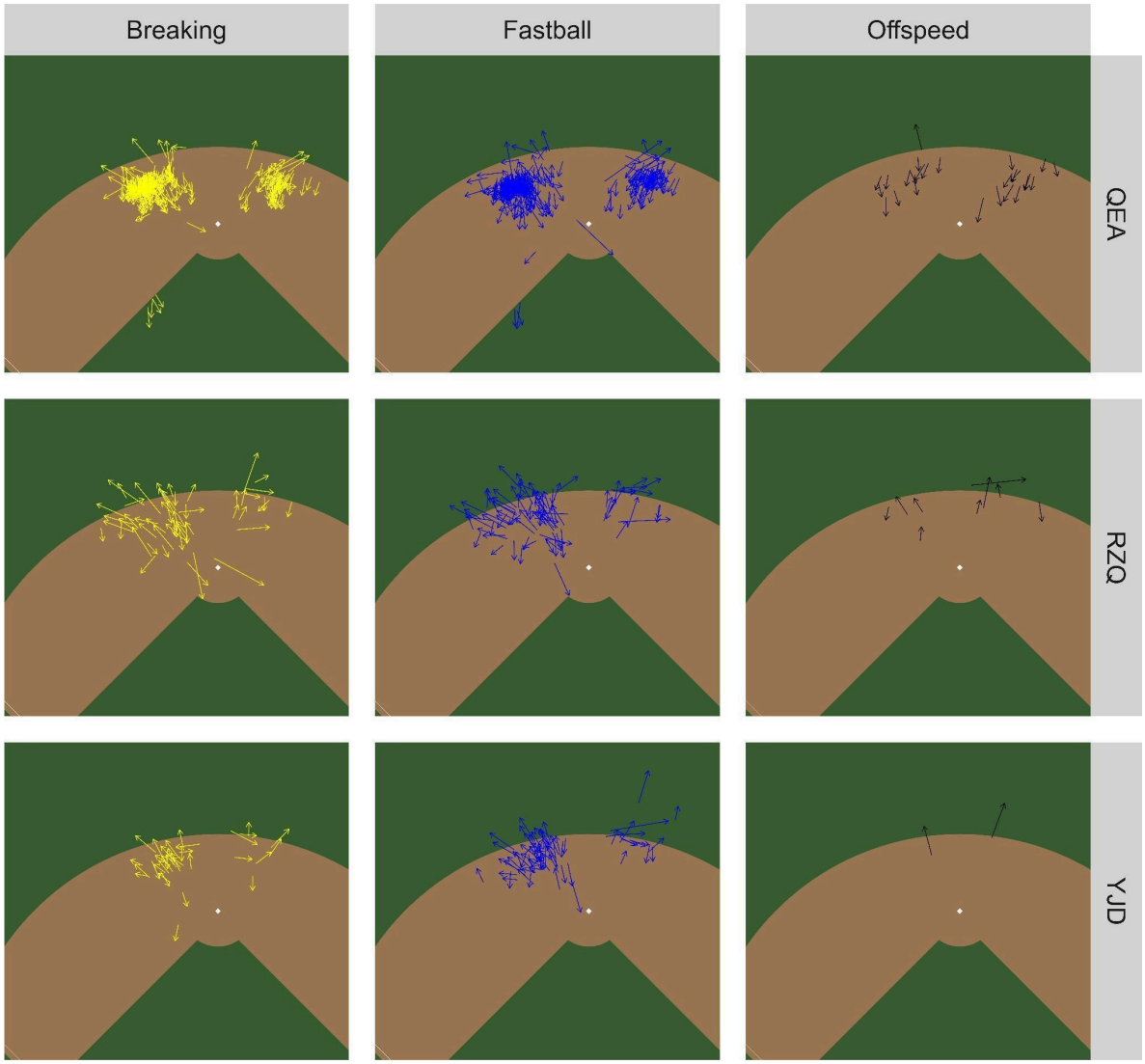
Who: Center Field **When** RHP vs LHH **Magnitude** t1 - margin = 0.04148, p = 0.01137 **Sample Size** 1053 plays	**How** Positioning further to the left corresponds to more offspeed **Why** *Opposes Intuition:* A center fielder would presumably want to play closer to the opposite field on fastballs, but here they are doing the opposite.	**Viewing Area** 

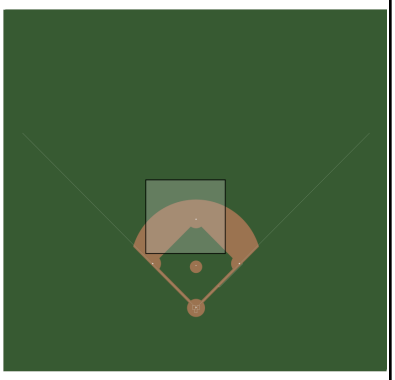


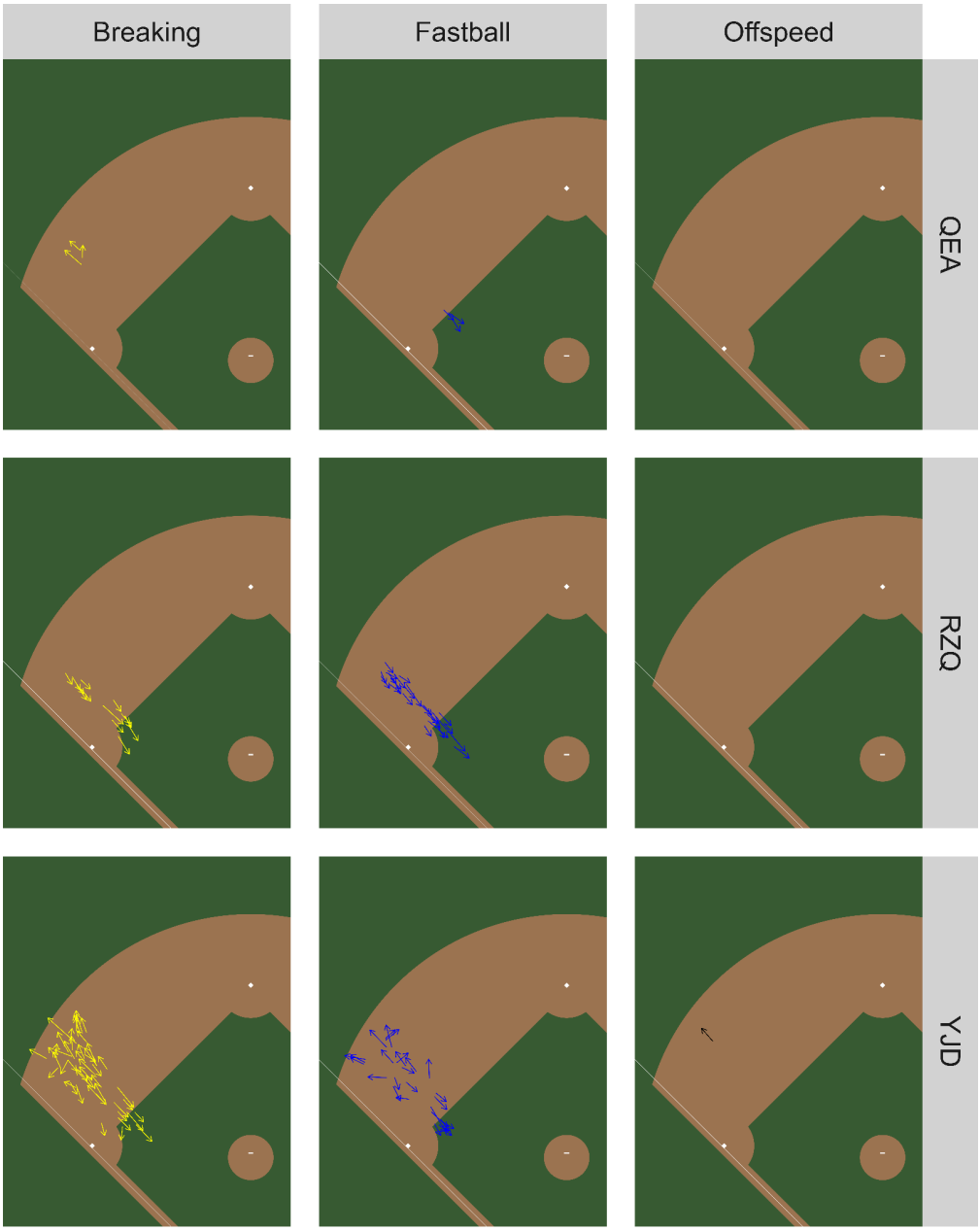
Who: Right Field **When** LHP vs RHH **Magnitude** t1, margin = -0.0808, p = 0.0470 **Sample Size** 170 plays	**How** Positioning further to the left corresponds with less offspeed **Why** *Opposes Intuition:* A right fielder would presumably want to play closer to the opposite field on fastballs, but here they are doing the opposite.	**Viewing Area** 

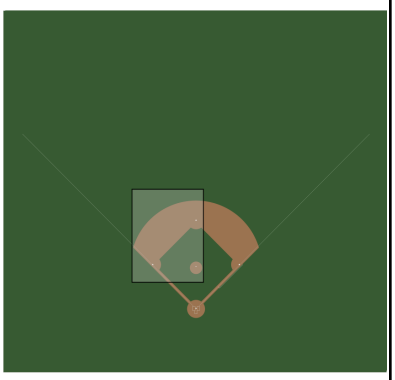


Who: Shortstop **When** LHP vs RHH **Magnitude** r_delta: margin = -0.06949, p = 0.0218 **Sample Size** 103 plays	**How** Moving further in/less out before the pitch correlates with fewer offspeed/more fastballs **Why** *Matches Intuition:* Shortstops against righties might cover the steal more on fastballs, and here they stay closer to the base for fastballs than they do for breaking balls	**Viewing Area** 



Who: Shortstop **When** RHP vs LHH **Magnitude** r_delta: margin = -0.04893, p = 0.02194 **Sample Size** 875 plays	**How** Moving further in/less out before the pitch correlates with fewer offspeed/more fastballs **Why** *Opposes Intuition* Shortstops against lefties might cover the steal more on breaking balls, yet here they stay closer to the base for fastballs than they do for breaking balls.	**Viewing Area** 



Who: Third Baseman **When** LHP vs RHH **Magnitude** R_delta: margin = 0.114, p = 0.0138 **Sample Size** 121 plays	**How** Moving in towards the plate corresponds with more offspeed pitches **Why** *Agnostic to Intuition* We suspect this is an effect of third basemen charging further in on a bunt for offspeed pitches, but the advantage of this is unclear.	**Viewing Area** 

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