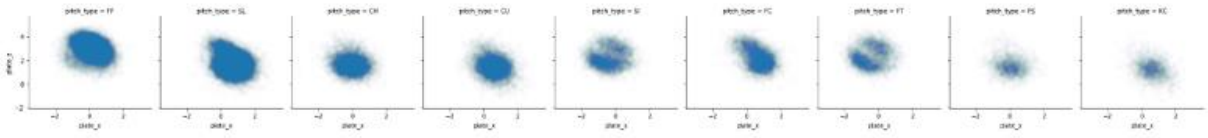
MLB Whiff Rates: 2008–2020

A whiff is a swing and a miss, no fouls tips, no called strikes. Since the MLB started tracking pitches in 2008, there have been more than 3 million pitches thrown, less than 10% of those were whiffed at. This is a breakdown of those pitches and pitch combinations that make batters whiff. (All data was obtained from MLB's baseballsavant website and analysis was done using python)

Overall whiff rates

When looking at batting and pitching statistics there are four different pitcher arm and batter stance scenarios to consider: lefty on lefty, lefty on righty, righty on lefty, and righty on righty. The charts below cover each scenario. The y axis represents the plate height, and the x axis represents the width of the plate from the catcher's point of view. Depending on the batters height the strike zone ranges in size but on average the zone falls between 1.5 and 3.5 on the y axis and remains constant between -1 and 1 on the x axis. Below each chart is a breakdown of the pitch types and their percentage of all whiff pitches thrown.

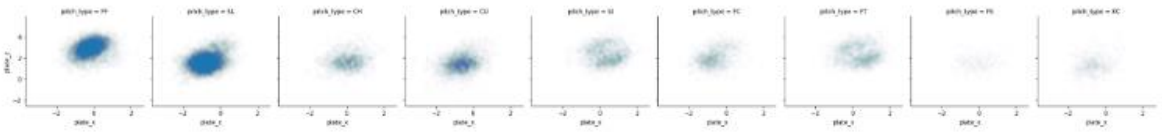


Pitcher: right,
batter: right

FF = four seam fastball: 26.6%
SL = slider: 31.2%
CH = change up: 9.1%
CU = curve: 9.4%
SI = sinker:5.7%
CU = cutter:6.5%
FT = two seam fastball:4.9%
FS = splitter: 2.4%
KC = knuckle curve: 2.4%

Sliders and four seam fastballs dominate the whiff pitches for this scenario. Whiff fastballs are thrown up and out of the strike zone, while whiff sliders are thrown down and away from the

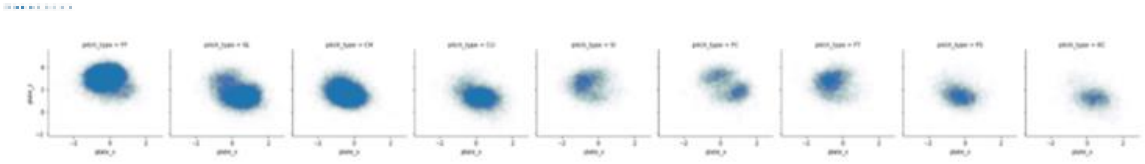
right-handed batter. The spray charts of the sinkers and two seam fastballs are divided into two clouds by what appears to be the bat path of right handed hitters making contact with pitches in the heart of the plate.



Pitcher: Left,
Batter: Left

four seam fastball: 25.4%
slider: 33.9%
change up: 6.8%
curve: 11.4%
sinker:7.3%
cutter: 4.8%
two seam fastball: 6.5%
splitter: 0.7%
knuckle curve: 1.8%

In the lefty on lefty scenario we see the same patterns in the opposite direction. Sliders and four seam fastballs dominate again, but we do see curveballs being thrown more.

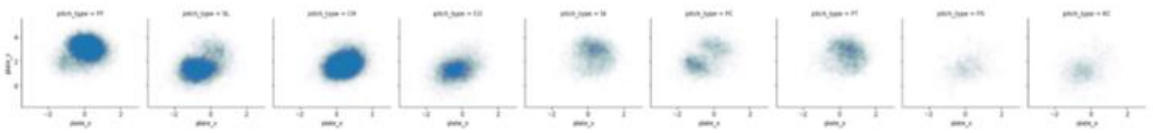


Pitcher: Right,

Batter: Left

four seam fastball: 26.2%
slider: 17.1%
change up: 20.9%
curve: 10.4%
sinker:5.2%
cutter:5.1%
two seam fastball:5.7%
splitter: 4.7%
knuckle curve: 3.1%

When a righty pitcher faces a lefty batter, change up whiff rate jumps. The changeup shades down and away from the left handed batter, while the four seam fastball is still effective when thrown high in the zone. The slider is still effective at 17.1% and is thrown is the same location as the R/R scenario but is located down and in on the left handed batter.



Pitcher: Left,

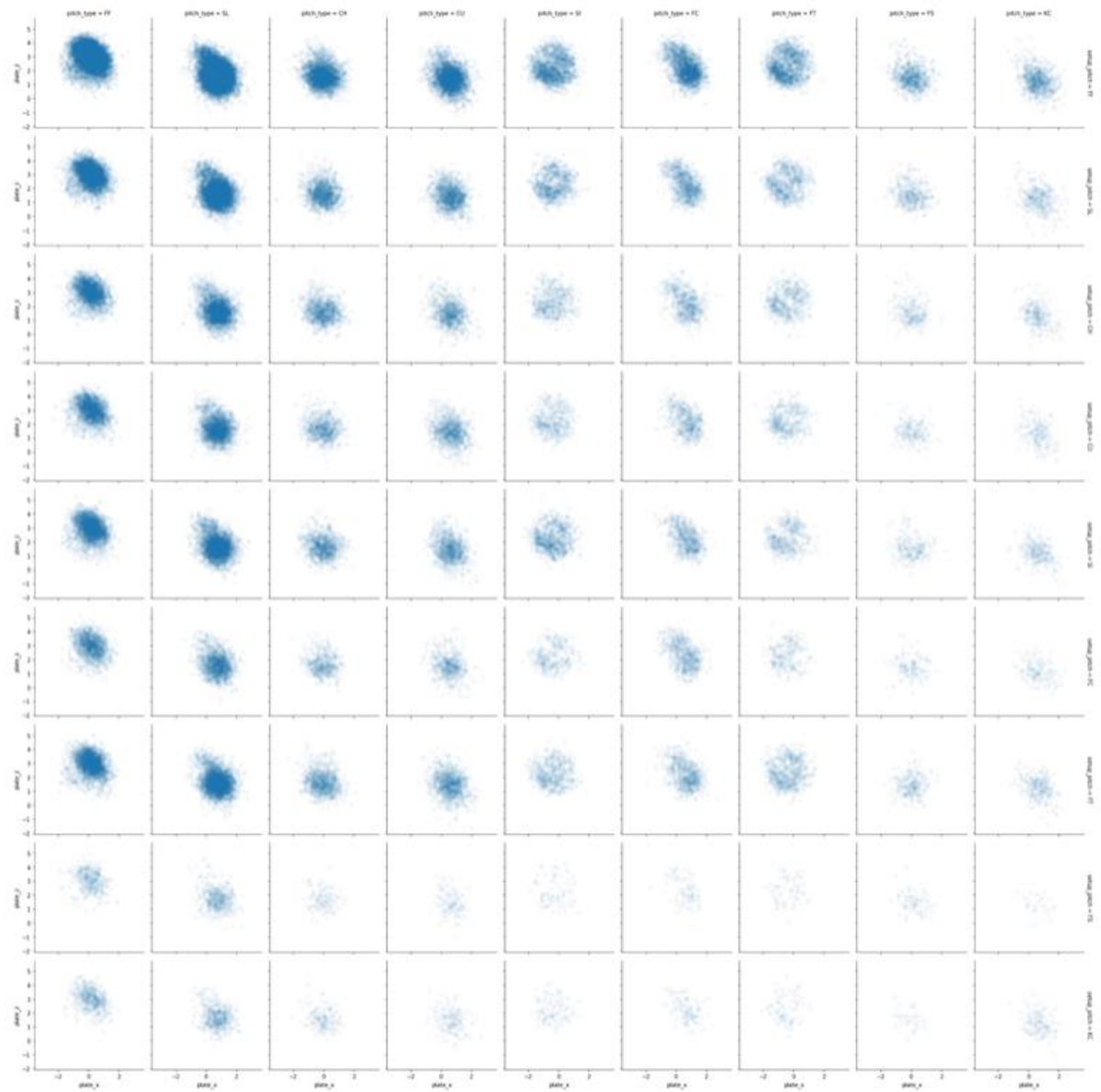
Batter: Right

four seam fastball: 24.3%
slider: 18.0%
change up: 25.6%
curve: 9.8%
sinker:6.1%
cutter:5.1%
two seam fastball:6.4%
splitter:1.4%
knuckle curve:0.4%

Again, when the stances are switched we see the same patterns in opposite directions. The same pitches are dominant, however in this scenario the changeup has a higher whiff rate.

Pitch combinations

Another aspect of whiff rate that must be considered is the pitch that sets up the whiff pitch. The charts below take the set up pitch into account. The columns remain the same, while the rows represent set up pitches. The spray chart in the top left corner is a four seam fastball set up by a four seam fastball, below that is a four seam fastball set up by slider. Etc.

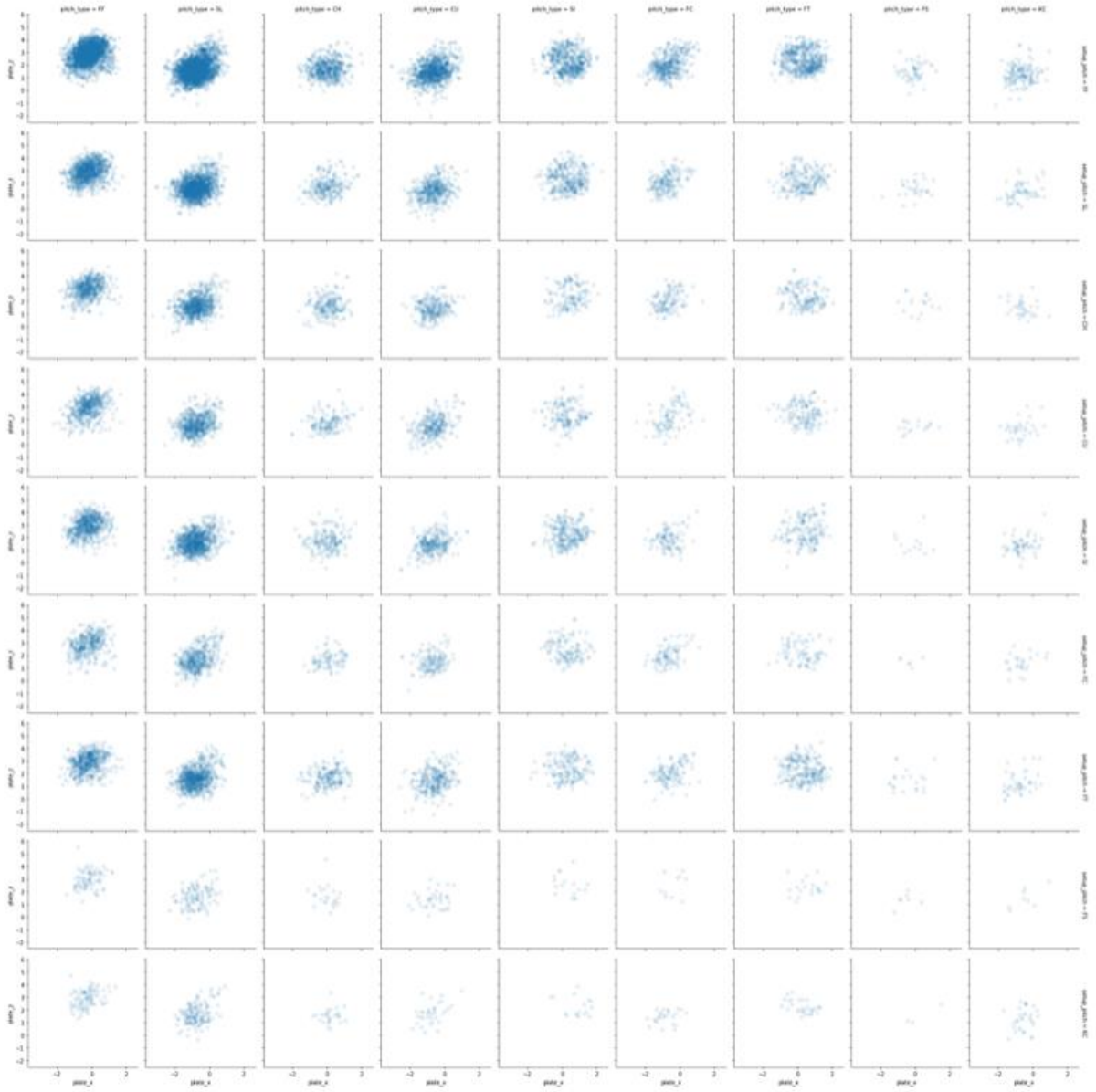


Pitcher: Right,
Batter: Right

```
Top pitches:
   1. Slider set up by a four seam  :  10.9%
   2. Four seam set up by a four seam: 9.9%
   3. Slider set up by a slider  :  5.6%
   4. Four seam set up setup slider  :  4.2%
   5. Slider set up by a sinker  :  3.3%
```

The slider set up by a four seam has the highest whiff rate (10.9%) in this scenario. The highest overall rate belongs to sliders accounting for 31.2% of all right on right whiffs edging out four

seam fastballs at 26.6%. Although the slider edges out the four seam fastball, the fastball is the better setup pitch.

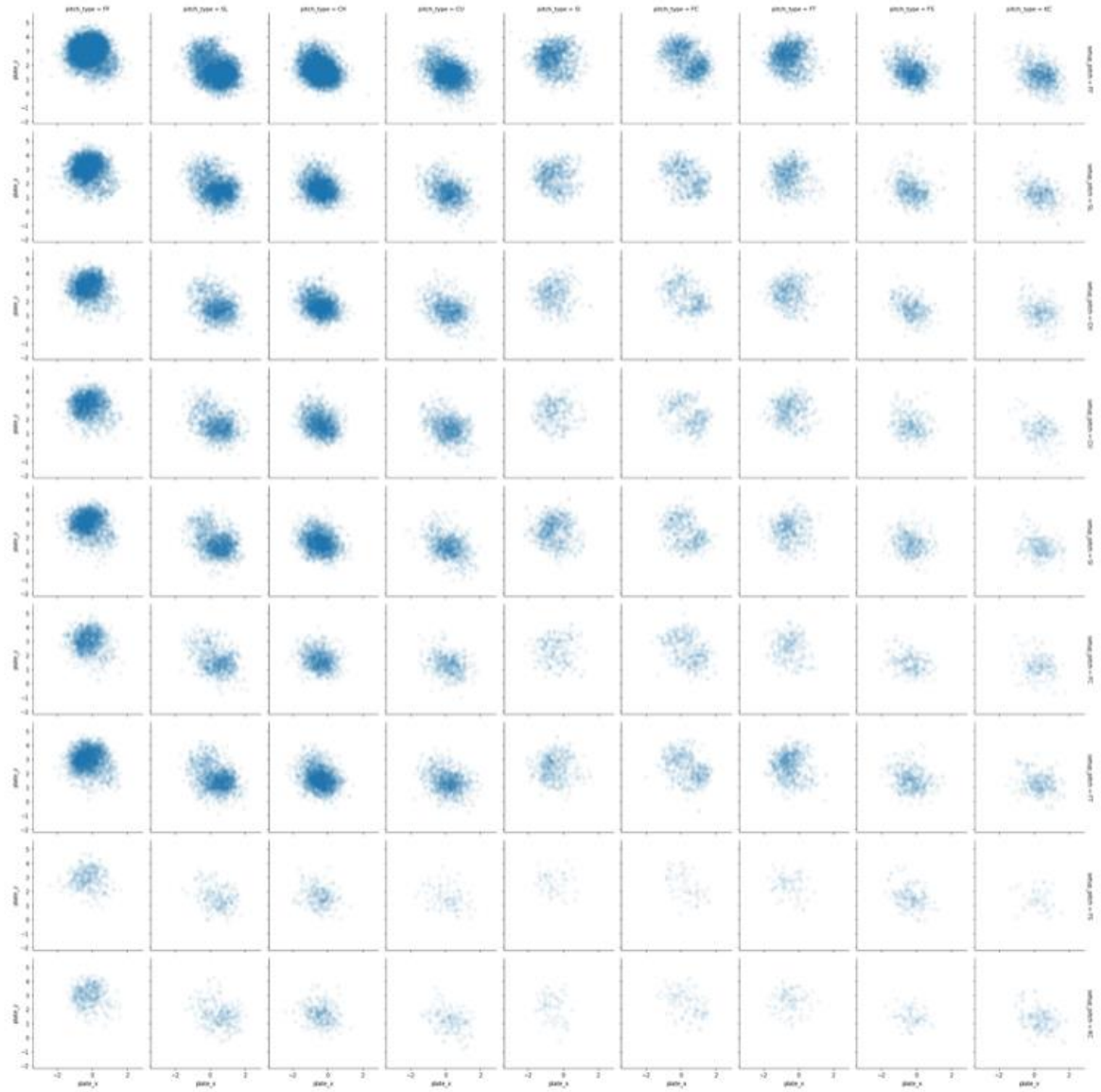


Pitcher: Left,

Batter: Left

```
Top pitches
   1. Slider set up by a four seam  :  11.3%
   2. four seam set up by a four seam  :  9.5%
   3. Slider set up by a slider  :  6.4%
   4. Four seam set up by a slider  :  4.1%
   5. Curve ball setup four seam  :  4.1%
```

Once again we see as the stances are reversed the patterns remain, additionally the top five pitches are nearly identical. Of all pitcher, batter, and pitch combinations the highest whiff rates comes from a lefty pitcher throwing a slider to a lefty batter that is set up by a four seam fastball.

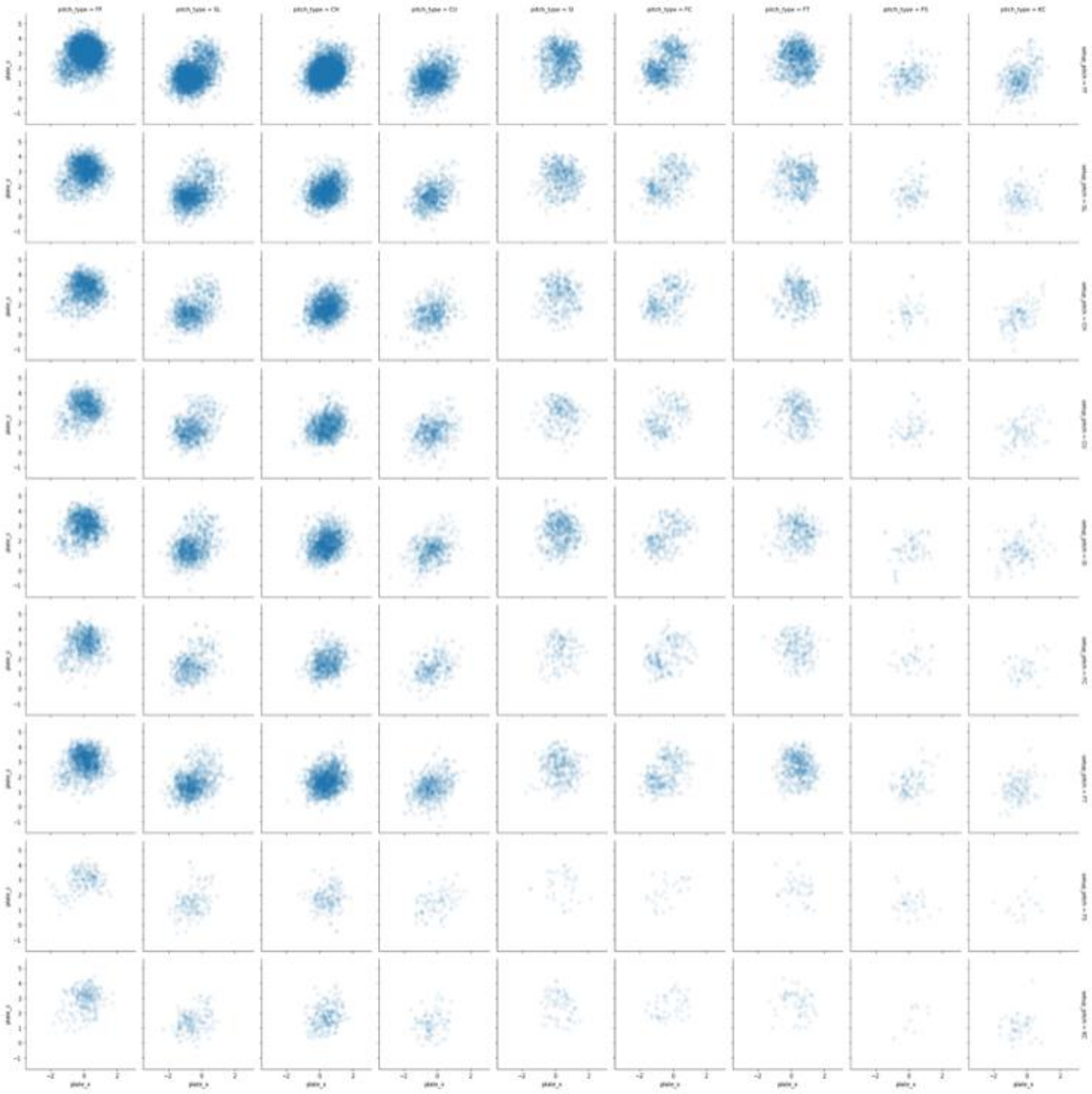


Pitcher: Right,
Batter: Left

```
Top pitches:
   1. Four seam set up by four seam  : 9.7%
   2. Change up set up by a four seam  :  7.1%
   3. Slider set up by a four seam  :  5.9%
   4. Four seam set up by a slider  :  3.9%
   5. Curve ball set up by a four seam  :  3.6%
```

In an opposite stance scenario the four seam fastball followed by another four seam fastball takes the top spot compared to the slider in the previous two scenarios. The four seam is the top pitch

and setup pitch at 26.2% and 34.1%, respectively. The change up comes into play at 20.9% of righty lefty whiffs. It is most effective when set up by the four seam fastball.

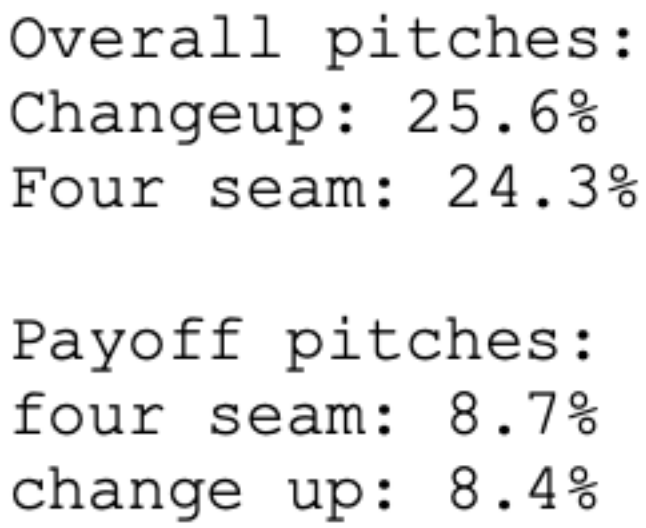


Pitcher: Left,
Batter: Right

```
Top pitches:
   1. Four seam set up by a four seam  :  8.7%
   2. Change up set up by a four seam  :  8.4%
   3. Slider setup by a four seam  :  6.2%
   4. Change up set up by a slider  :  3.5%
   5. Curve ball set up by a four seam  :  3.4%
```

Matching the previous scenario the top pitch is a four seam followed by a four seam, however, the top overall pitch is a change up consisting of 25.6% of all lefty righty whiffs. This is the first scenario where there is a discrepancy between top overall pitch, and the top pitch considering set up pitches. In both the RR and LL scenarios the slider occupies both top overall and top pitch considering set up pitches. In the RL scenario it is the four seam. This begs the question, can pitchers in a LR scenario achieve more whiffs by throwing the fastball more often?

In a LR scenario, pitchers achieve a .3% higher whiff rate throwing a four seam set up by a four seam compared to throwing a change up followed by a four seam. Pitchers do throw the four seam combination 1% more often, however changeups account for 1.3% more whiffs than four seams overall.



Pitcher: Left, Batter: Right whiff rates:

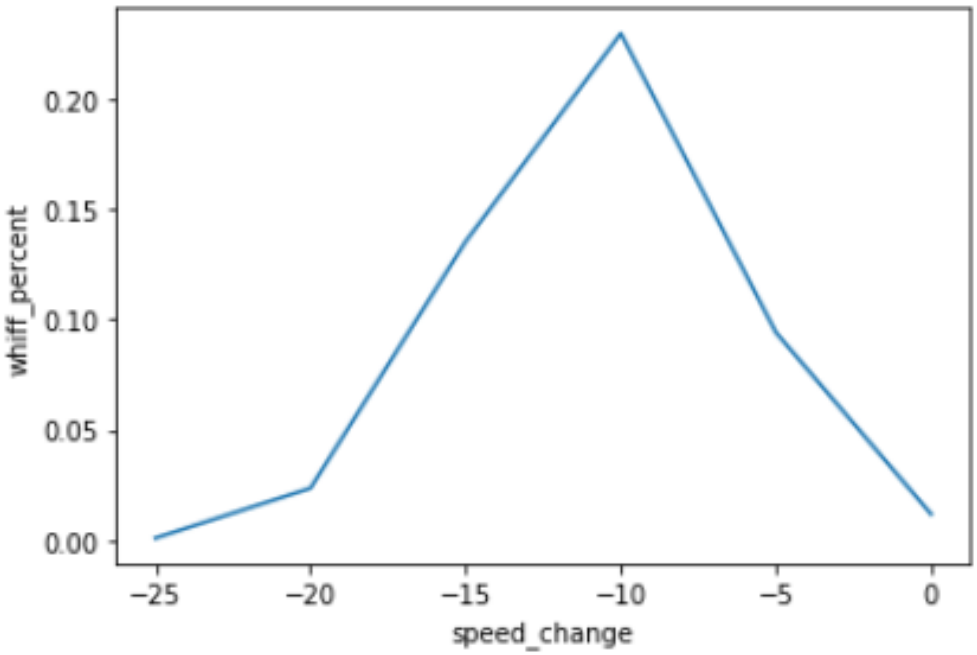
This indicates that although the combination of four seam setup by a four seam is more effective in getting a whiff, the change up is more effective overall due to its whiff rate when set up by other pitches. The change up whiff rate when set up by pitches other than a fastball has an average whiff of 2.1%, while the four seam whiff rate when set up other pitches has an average of 2%. This tells us that although a setup of a four seam is better followed by a four seam, overall the change up is a better whiff pitch when considering a pitchers total arsenal.

Best combinations

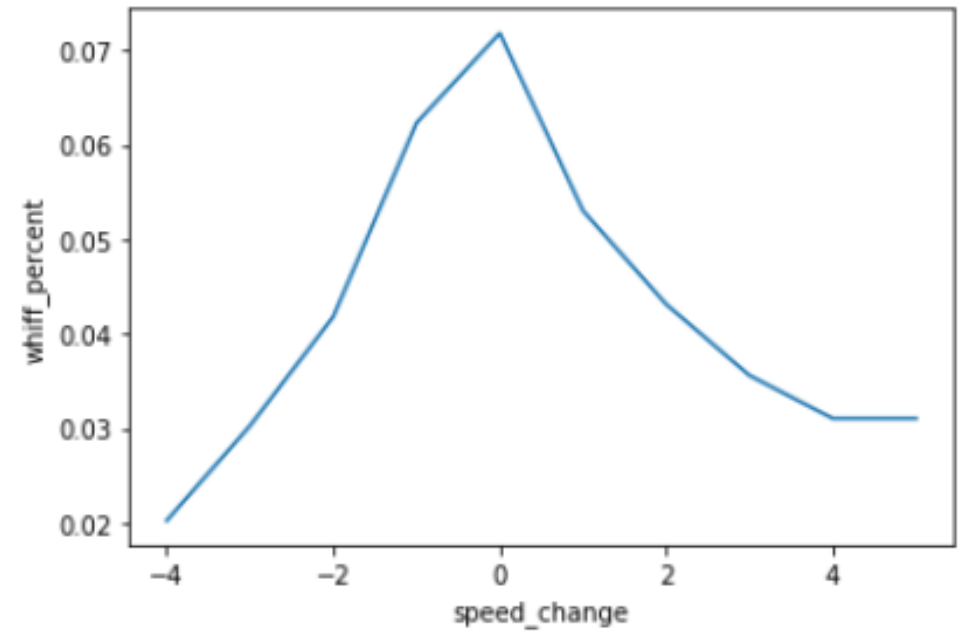
RR:
slider set up by four seam: 10.9%
four seam set up by four seam: 9.9%
LL:
slider set up by four seam: 11.3%
four seam set up by four seam: 9.5%
RL:
four seam set up by four seam: 9.7%
change up set up by four seam: 7.1%
LR:
four seam set up by four seam: 8.7%
change up set up by four seam: 8.4%

In each scenario the top whiff pitch is set up by a four seam fastball, then followed by either another fastball or an off speed pitch. After a fastball is thrown the batter must prepare for another fastball or a pitch of a different velocity. With the data from statcast we can also chart how whiff percent changes when compared to change in velocity from the set up pitch.

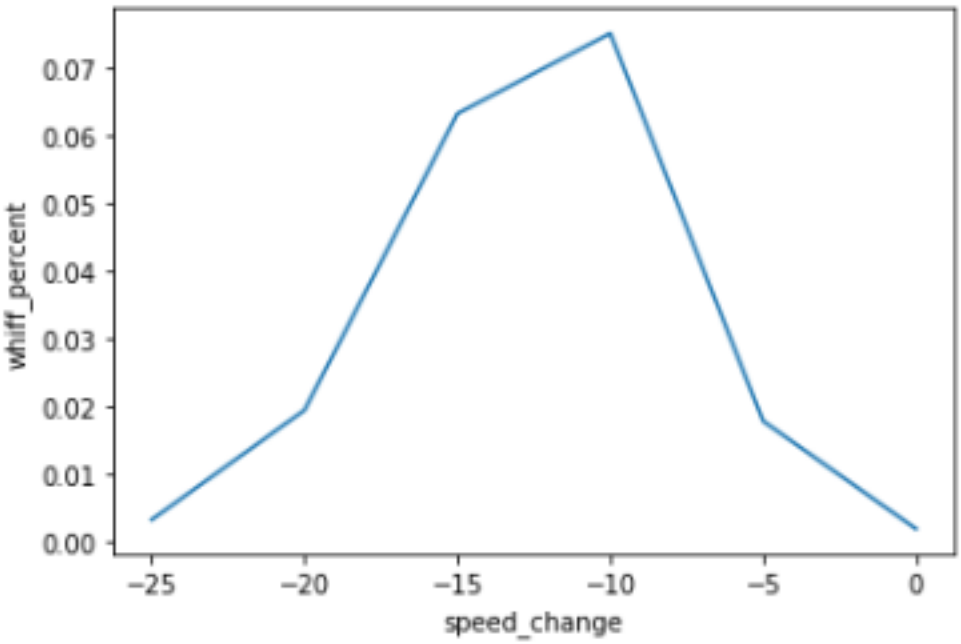
When a slider is set up by a four seam a drop in velocity of around 10 MPH achieves the highest whiff rate.



When considering a fastball set up by a fastball, surprisingly an increase in velocity does not increase the whiff rate.



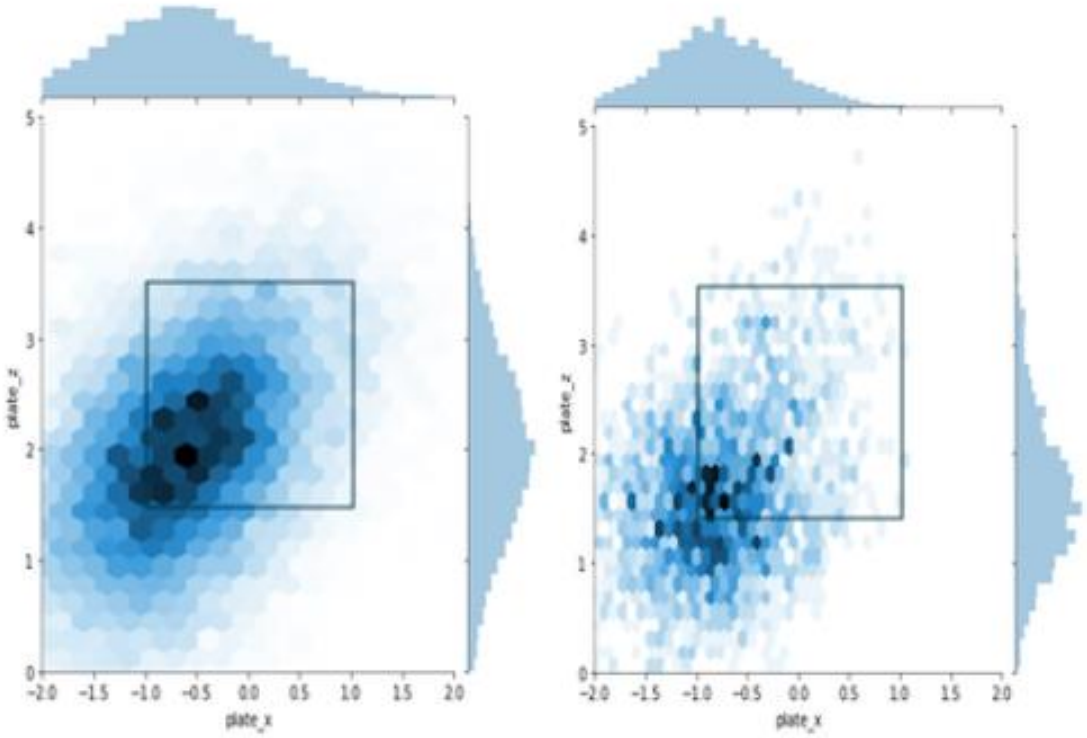
Similar to the slider, a change up set up by a slider is most effective when 10 MPH is taken off.



Location

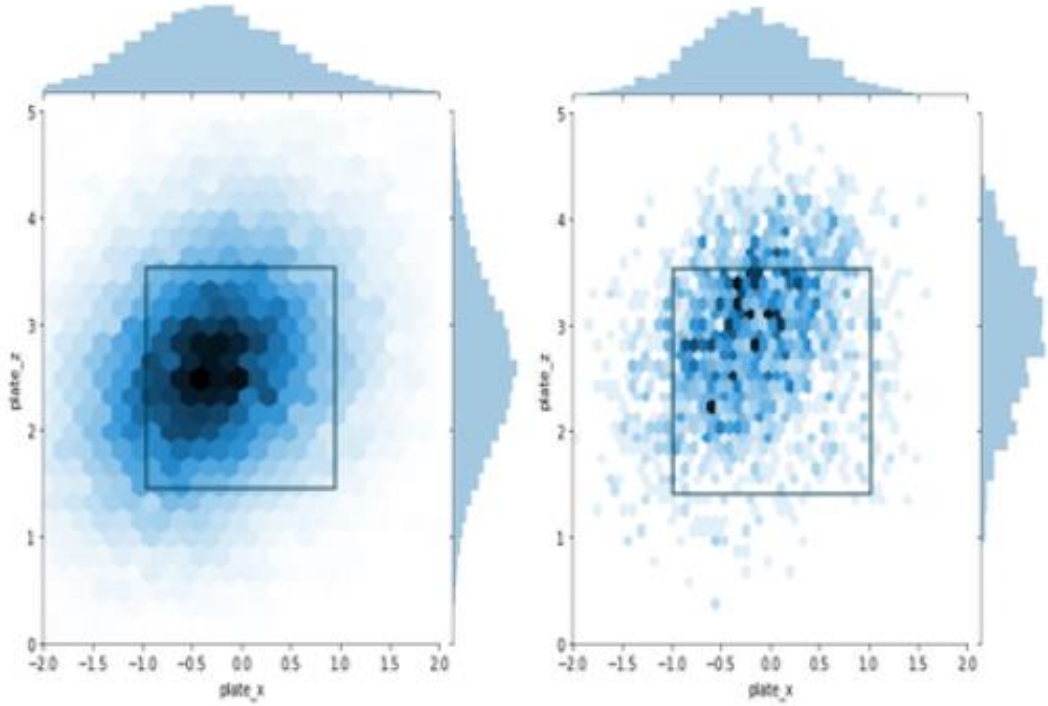
In addition to looking at the change in velocity between a whiff pitch and it's set up pitch, we can look at the difference in location of the two pitches.

Pitcher: Left, Batter: Left



Left: set up four seam, Right: whiff slider

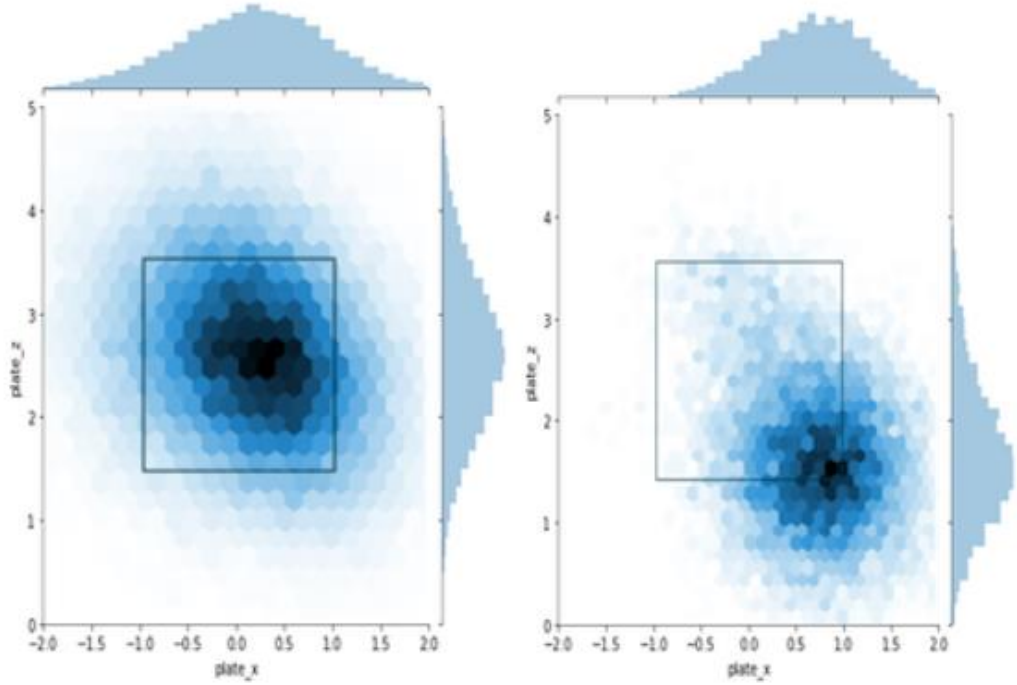
Again, here is the most effective whiff pitch in baseball. The set up four seam is thrown down and away and the whiff slider is painting the outside corner.



Left: set up four seam: Right: whiff four seam

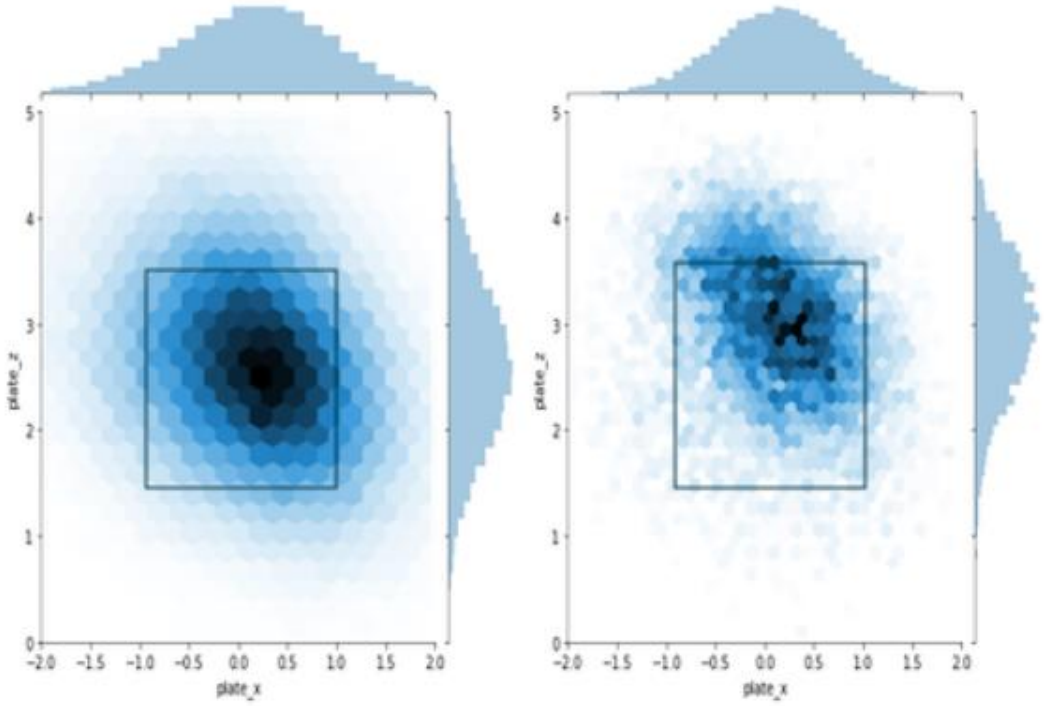
In this combination the set up four seam is located slightly above the slider combination, and the whiff four seam is elevated as well.

Pitcher: Right, Batter: Right



Left: set up four seam, Right: whiff slider

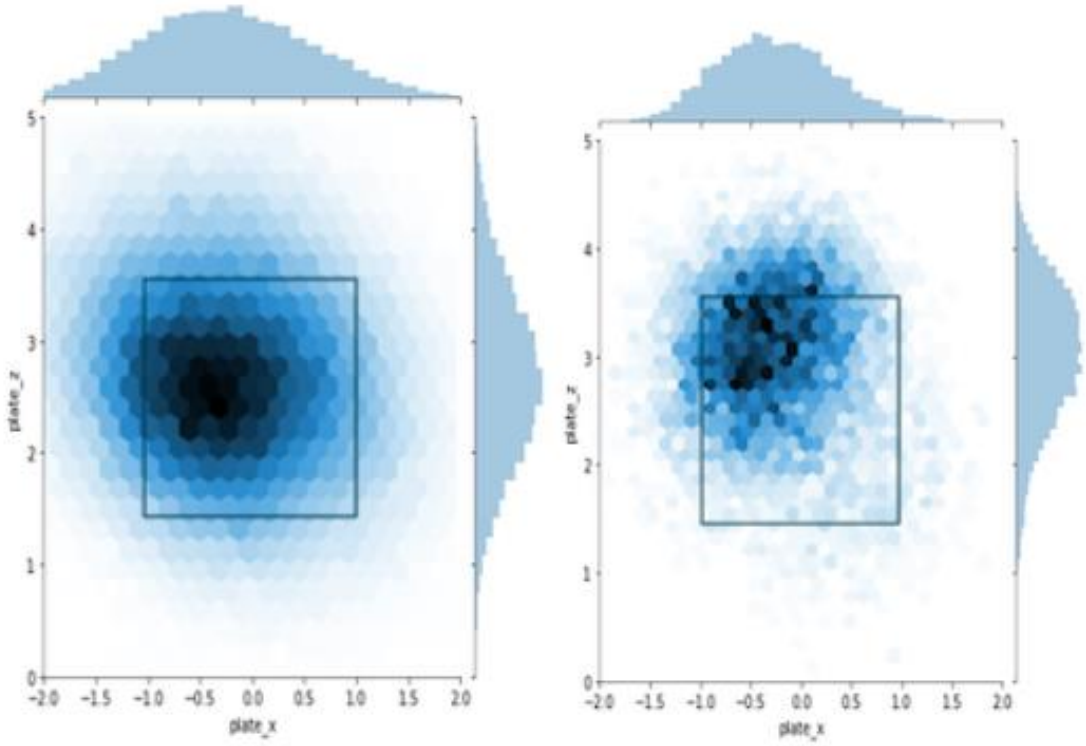
Compared to the LL scenario of this pitch combination the set up four seam is more in the heart of the zone. But again, the whiff slider is painted on the outside corner.



Left: set up four seam: Right: whiff four seam

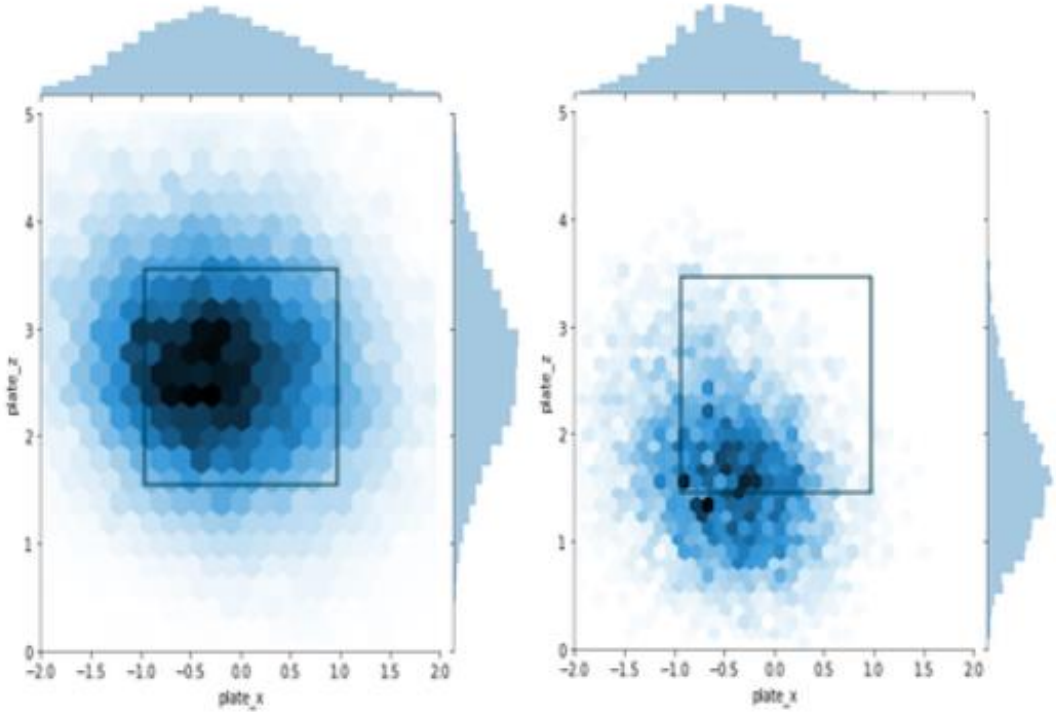
The spray chart of this combination is very similar to the LL combination. Set up away, elevated whiff.

Pitcher: Right, Batter: Left



Left: set up four seam, Right: whiff four seam

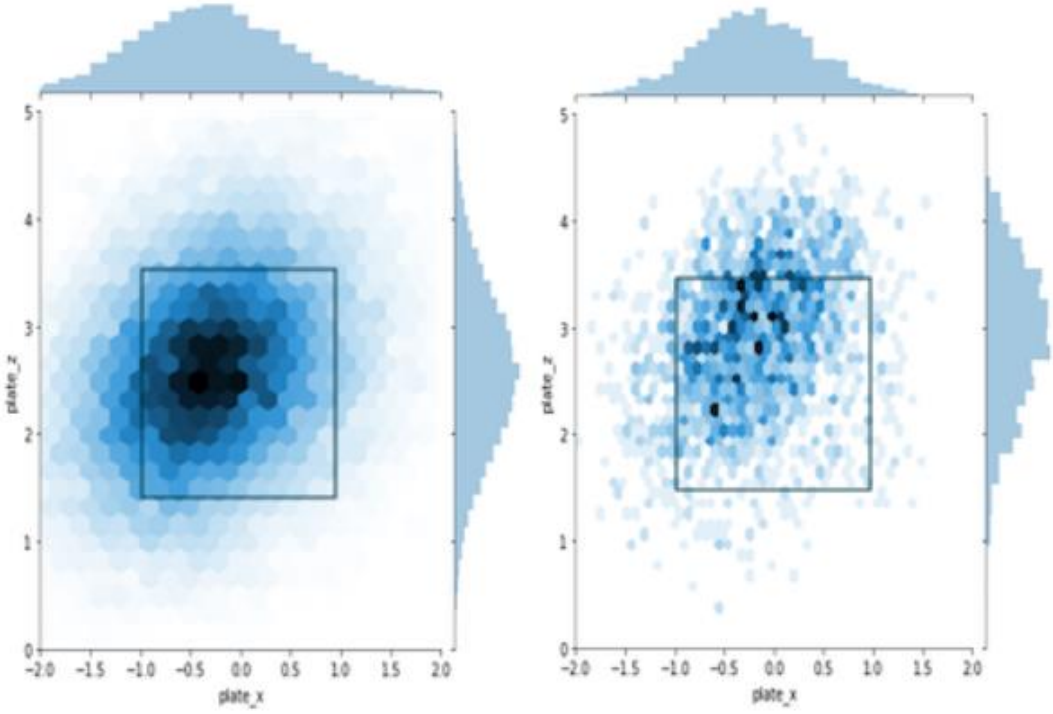
Similar spray patterns are seen as compared to other scenarios with this pitch combination.



Left: set up four seam, Right: whiff change up

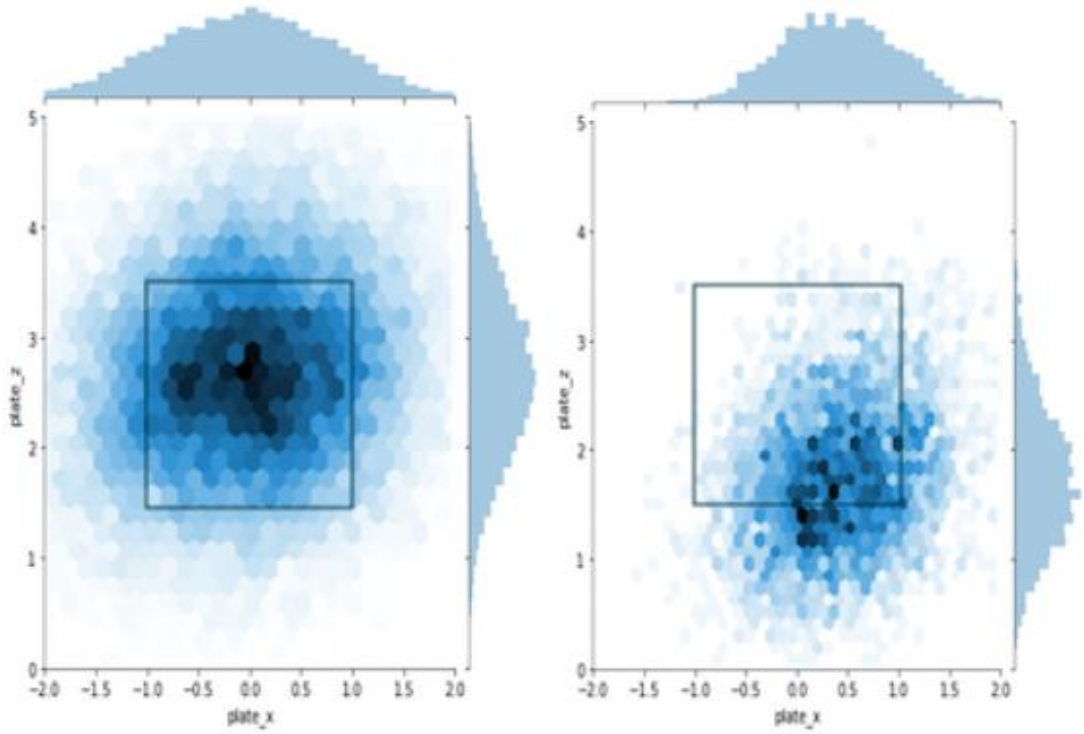
Again the fastball is set up on the outer part of the plate, and the whiff change up is located on the outside corner.

Pitcher: Left, Batter: Right



Left: set up four seam Right: whiff four seam

A break in the pattern is seen in this scenario. In the RL scenario for this pitch combination pitchers targeted the outer edges of the plate, where here lefty pitchers target the inner portion of the plate.



Left: set up four seam, Right: whiff change up

Compared the to the RL scenario of this combination the lefty pitchers locate the set up four seam more in the heart of the plate. The whiff change up is located down and away, matching the RL scenario.

Player analysis

Of all pitchers in the past twelve years, Josh Hader has the highest whiff rate of any player with a minimum of 1,000 pitches thrown. Here whiff rate is defined as percentage of pitches that were whiffed by the batter, divided by total pitches thrown.

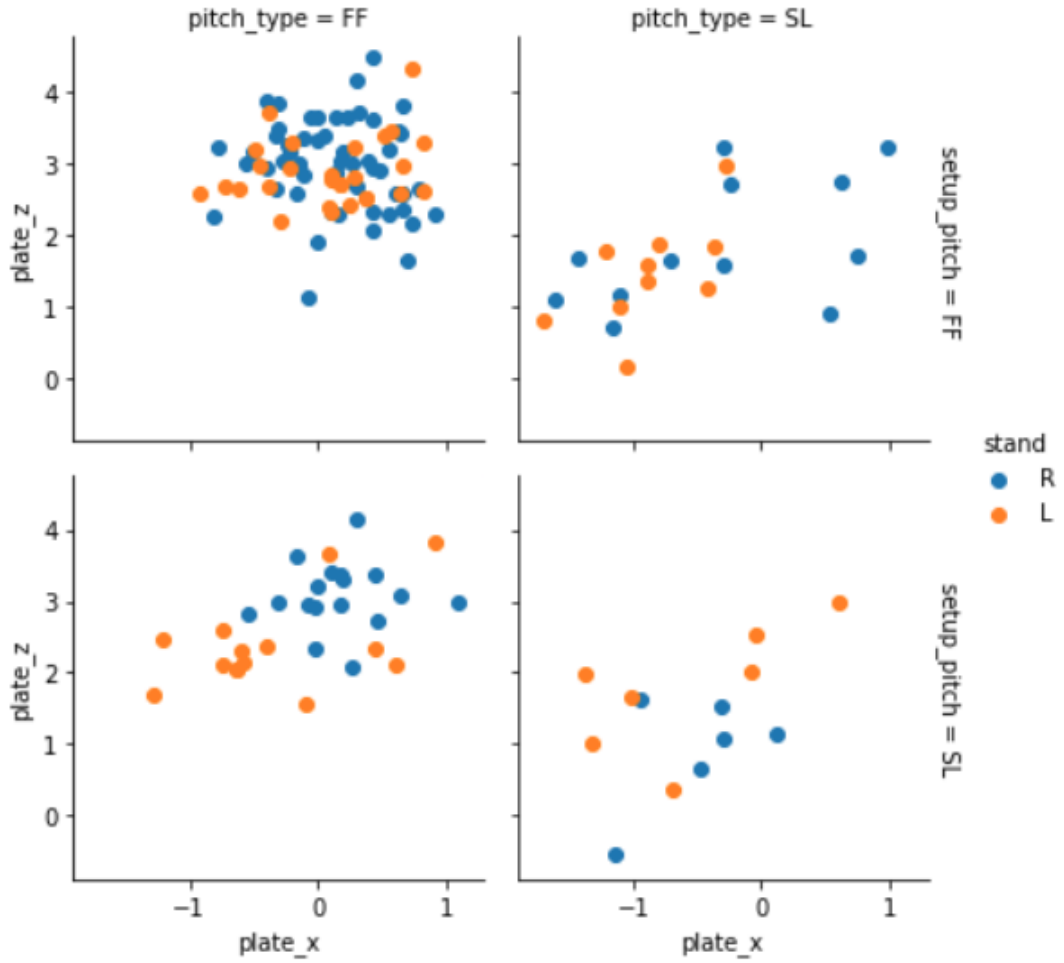
player_name	whiff_rate
Josh Hader	0.200292
Hector Neris	0.174679
Edwin Diaz	0.169915
Michael Wuertz	0.166073
Greg Holland	0.162300
Koji Uehara	0.161395
Ken Giles	0.159858
Kenley Jansen	0.159732
Joaquin Benoit	0.159428
Seunghwan Oh	0.158985

Josh hader, Hector Neris, and Edwin Diaz are all relivers. If we look at pitchers with a minimum pitch count of 10,000, the top starters are revealed.

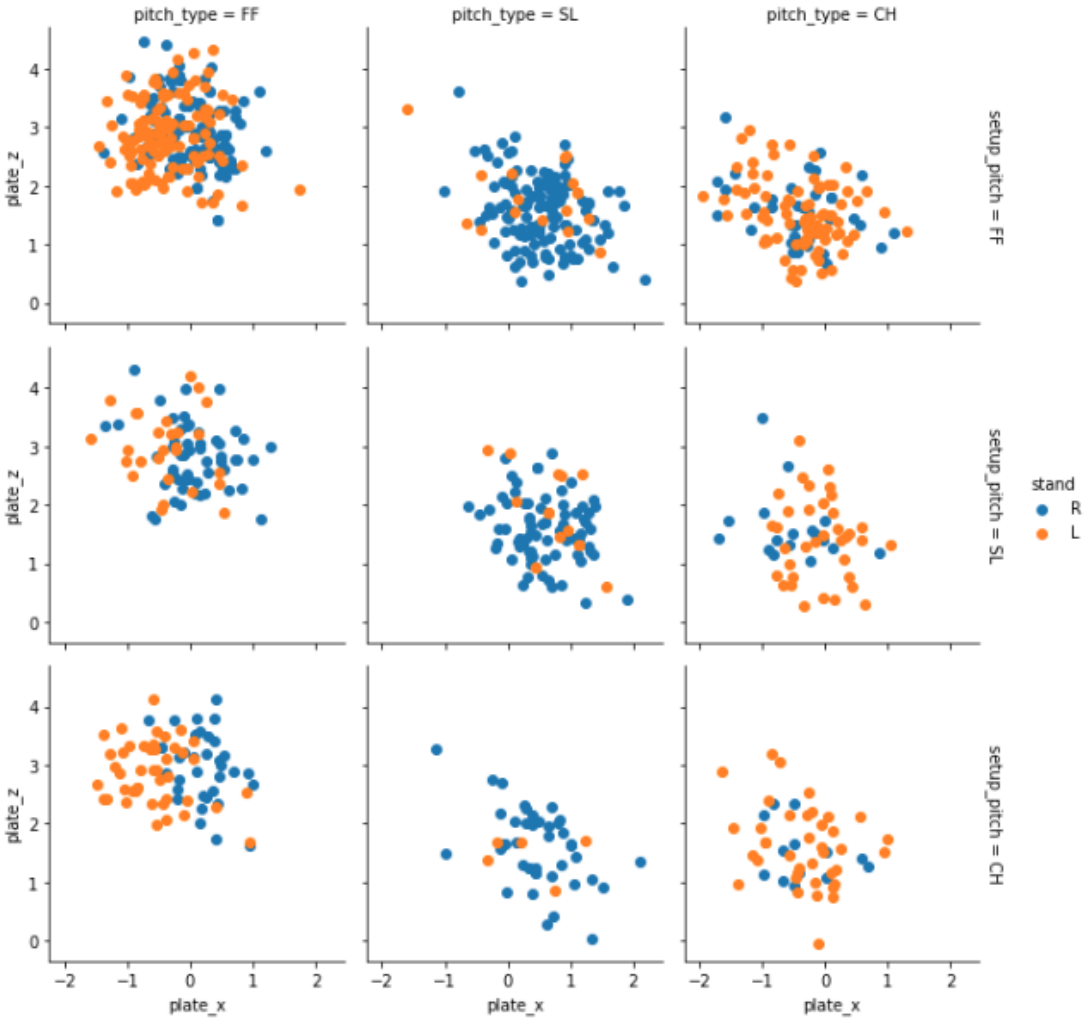
player_name	whiff_rate
Max Scherzer	0.136486
Cole Hamels	0.116502
Francisco Liriano	0.116488
Tim Lincecum	0.115498
Clayton Kershaw	0.114831
Justin Verlander	0.112637
CC Sabathia	0.111224
Anibal Sanchez	0.109547
James Shields	0.103342
Madison Bumgarner	0.103291

Max Scherzer and Josh Hader both lead the competition by substantial margins. Lets break down their arsenals.

Hader has two main pitches, a four seam fastball and a slider. His best pitch, the four seam fastball, accounts for 71.4% of his whiffs. 36.1% of those fastballs were set up by another fastball. He throws this pitch up in the zone on both parts of the plate to both lefties and righties as seen below.



Max Scherzer has three main pitches, a four seam, a slider, and a change up. Scherzer's whiff rates are spread somewhat evenly across the three pitches with the fastball ranking the highest at 42.2%. Of those fastballs his highest whiff pitch combination is a four seam followed by a four seam. He throws this combination mainly to lefties and elevates it on the outer edge of the plate. He also has a high whiff percentage when throwing his changeup to lefties down and away. Against righties his highest whiff pitches are fastballs up in the zone and sliders down and away.



Whiff's don't correlate with ERA, strikeouts, or saves but they do give insight into the mental game between the pitcher and batter. After a set up pitch of a fastball, is the pitcher going to throw another heater up in the zone or a slider down and away?