Recipe for Success:
The Secret Sauce for Effective Late-Game Pitching

By Drew DiSanto, James Hyman, Kushal Shah, Bailie Brown, Colin Krantz

Table of Contents

Methodology

The goal of our analysis was to figure out which specific factors impacted success of pitchers the most the third time through the batting order. We scraped pitch by pitch statcast data for the past five seasons and clumped positive and negative outcomes together in order to see what statistical categories most adversely affected pitcher performance.

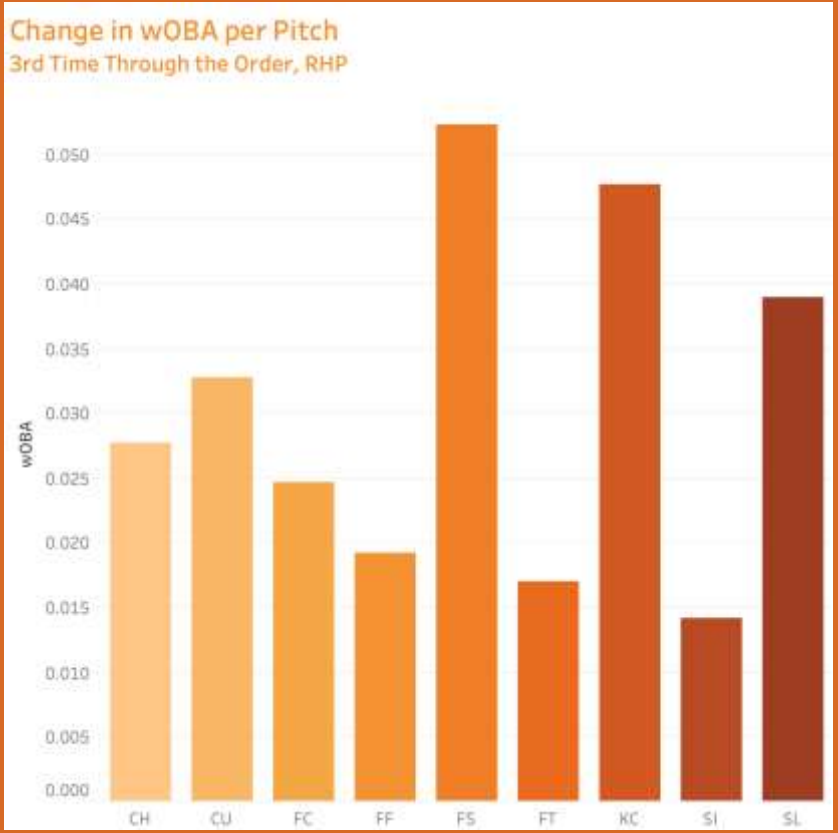
We decided to first look at the types of pitches that each player threw in order to understand how they regress on an individual level. We chose wOBA allowed as our wholistic dependent variable to account for the weight of the outcome that occurs.

Pitch Type

We ran a regression to model the change in wOBA of each pitch type from the first and second time through the order to the third time through the order.

We then repeated the regression to model the change in wOBA for righties and lefties.

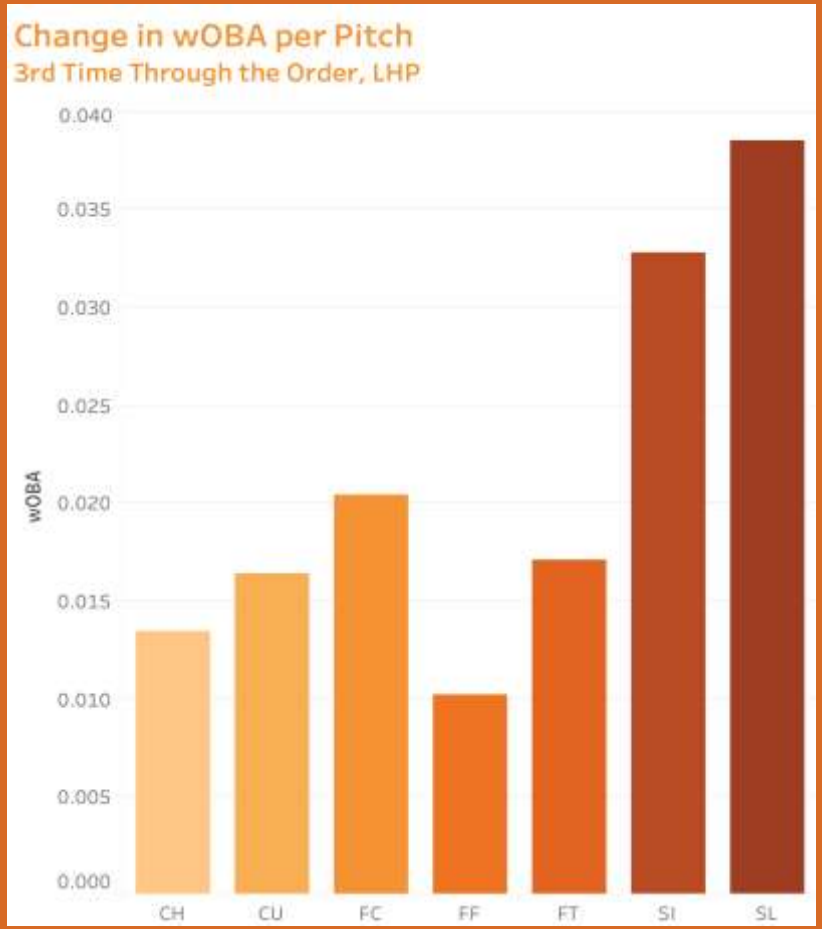
Change in wOBAper Pitch: 3rd Time Through the Order		
Pitch Type	**Coefficient**	**p-value**
FF	0.0167	2.09E-08
FT	0.0171	0.0001
SI	0.0204	0.0005
CH	0.0227	1.08E-07
FC	0.0233	0.0003
CU	0.0285	3.38E-08
KC	0.0381	0.0001
SL	0.0389	2.00E-16
FS	0.0478	0.0001



Righties

Splitters, Knuckle-Curves, and Sliders were the three worst pitches for right-handers in terms of added wOBA a third time through the lineup.

Sinkers regressed least of the statistically significant pitches from the first and second time through the order to the third.



Lefties

Sinkers and Sliders were determined to be the worst pitches for a lefty to throw when he faced a lineup for a 3rd time.

Fourseam fastballs exhibited the lowest decline in performance the third time through the order.

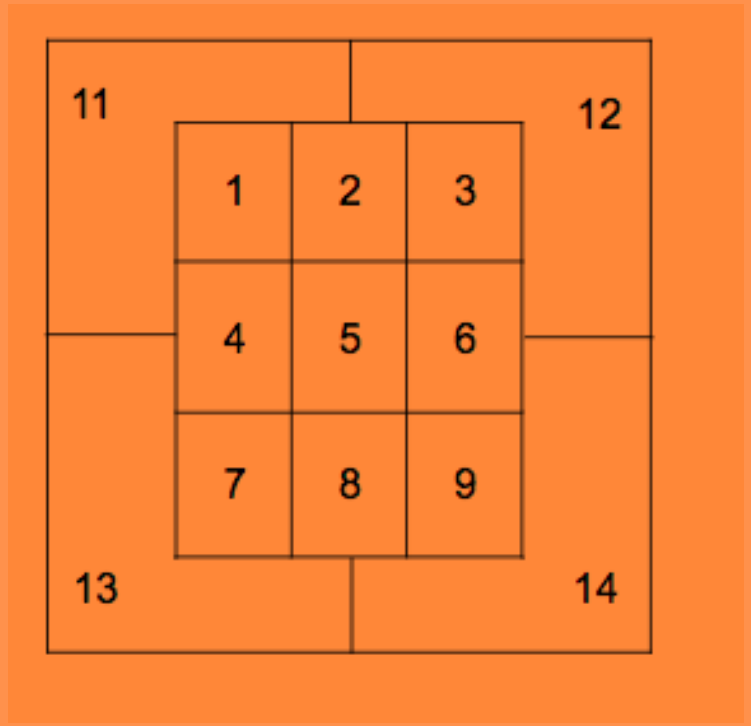
Control

We ran a regression of batters faced through a game for every start in the last five seasons and found that total movement of sliders decreased significantly the third time through the order with a coefficient of -.0118 feet. Subsequently, fourseam fastballs did not see a significant increase or decrease in movement.

The interpretation of these regression results is that pitches which rely on drastic movement performed worse as time went on because their average displacement was less. This will result in pitchers hanging their slider up in the zone, making them easier to hit.

Zone

As referenced in the previous slide, movement is only as important as the zone in which the ball ends up. We split the strike zone into 13 sub-sections to see where pitchers succeeded most with their pitches.



Selection Process

To decide which pitchers we wanted to investigate further, we established a model for both left and right handed players. We wanted to analyze players who threw three of the pitches that were the most effective based on our regressions and one that was the least effective. This would allow us to see whether the player could improve from a change in the types of pitches they threw later in games.

Lefty Model

Curveball, Fourseam, Changeup, Slider

Righty Model

Fourseam, Sinker, Changeup, Slider

Joe Musgrove

Team: Pittsburgh Pirates

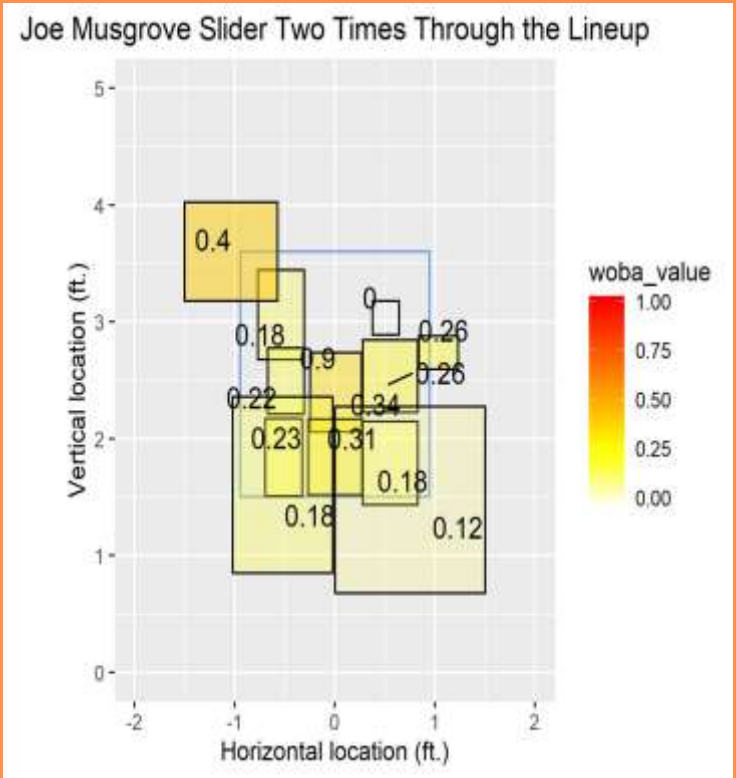
Hand: Right

Age: 27

Repertoire: FF, SI, CH, SL

Joe Musgrove - Slider			
Statistics	1st-2nd	3rd	% change
Percent Thrown	21.885	23.84	8.93%
Isolated Power Against	0.069	0.086	24.64%
Whiff Percentage	21.31	16.35	-23.28%

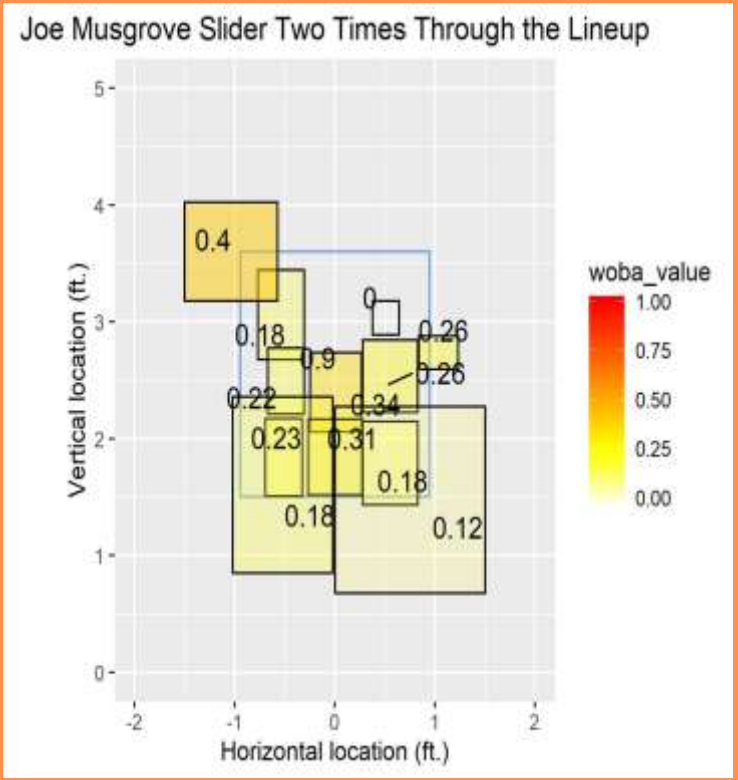
Joe Musgrove

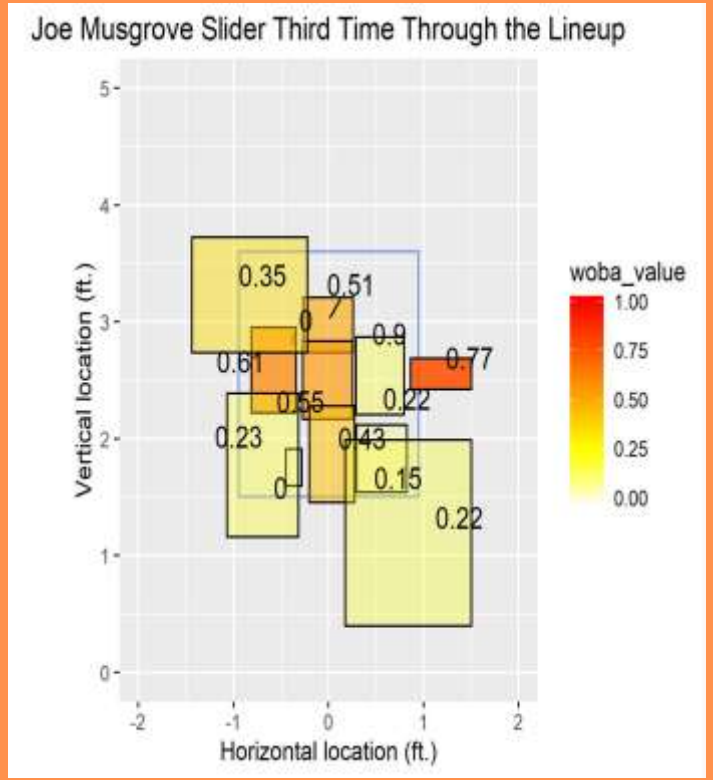


wOBA value is below average for almost all pitch zones when facing a lineup for the first two times

As Musgrove's slider rises in the zone throughout the game, however, his woba gets worse

Joe Musgrove





Jeff Samardzija

Team: San Francisco Giants

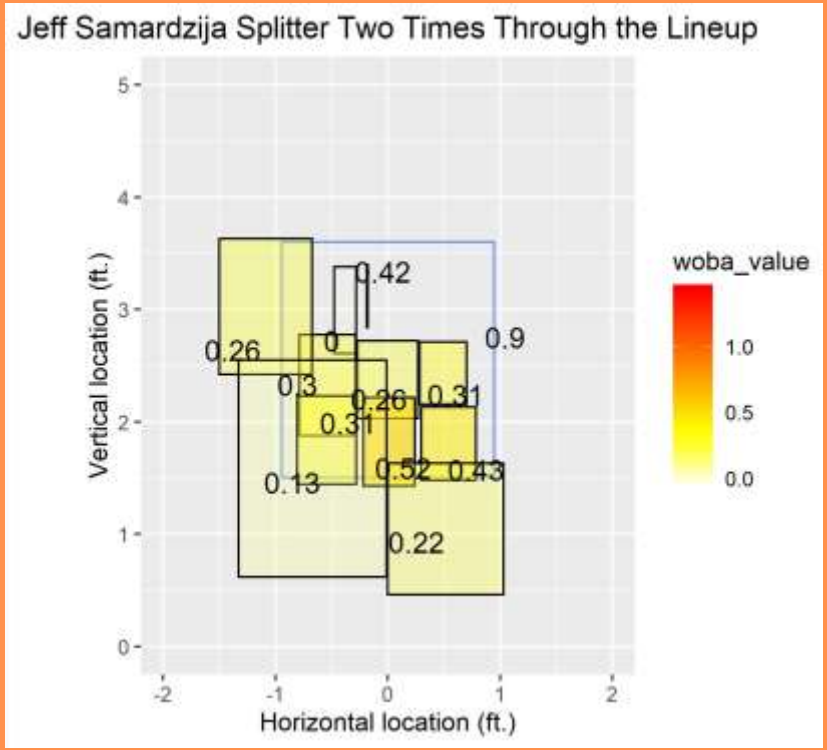
Hand: Right

Age: 35

Repertoire: FF, FC, CH, SL

Jeff Samardzija - Splitter			
Statistics	1st-2nd	3rd	% change
Percent Thrown	7.835	9.87	25.97%
Isolated Power Against	0.1305	0.75	474.71%
Whiff Percentage	21.375	9.09	-57.47%

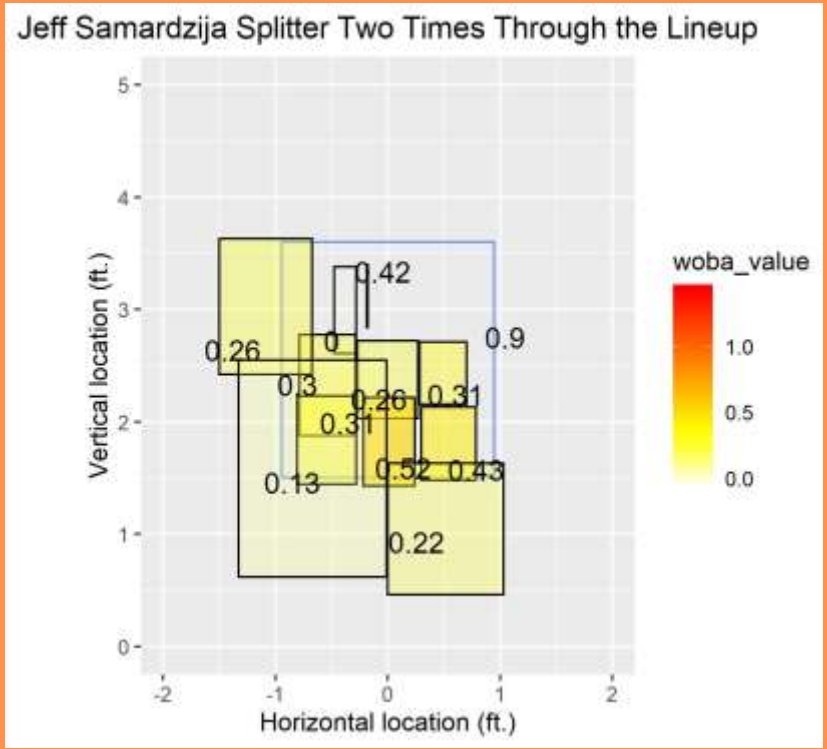
Jeff Samardzija

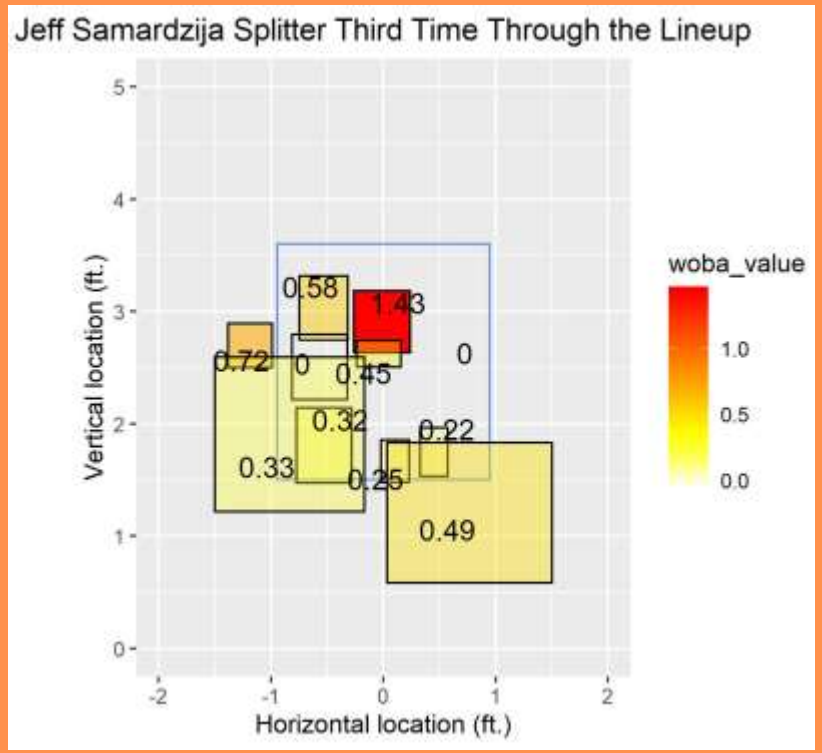


Samardzija's woba on his splitter is around or below average for most pitch zones when facing the lineup two times

Bottom inside corner (for a righty batter) produces the best woba value

Jeff Samardzija





John Means

Team: Baltimore Orioles

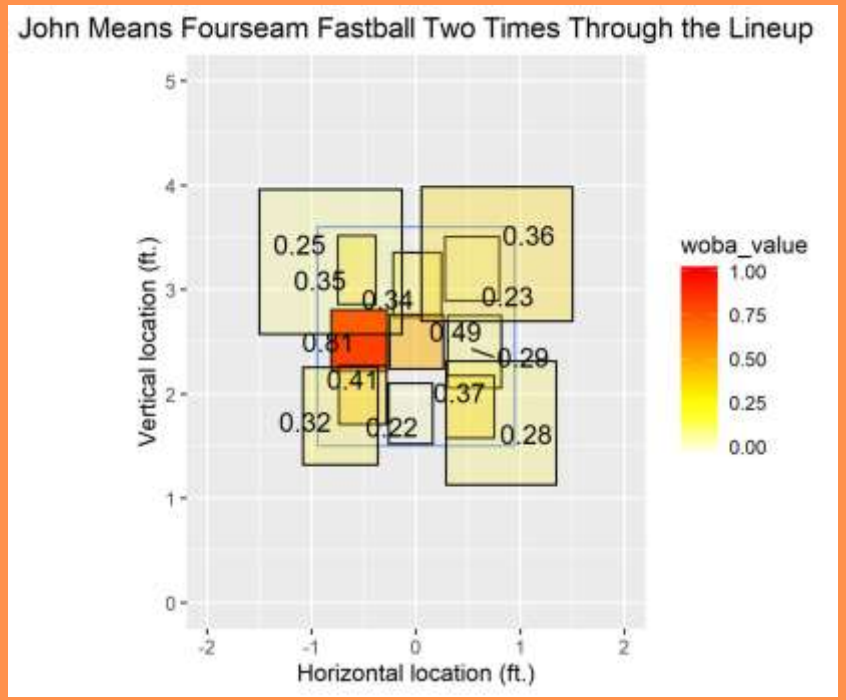
Hand: Left

Age: 26

Repertoire: FF, CU, CH, SL

John Means - Fourseam			
Statistics	1st-2nd	3rd	% change
Percent Thrown	50.835	49.5	-2.63%
Isolated Power Against	0.1965	0.049	75.06%
Whiff Percentage	8.09	7.2	-11.00%

John Means

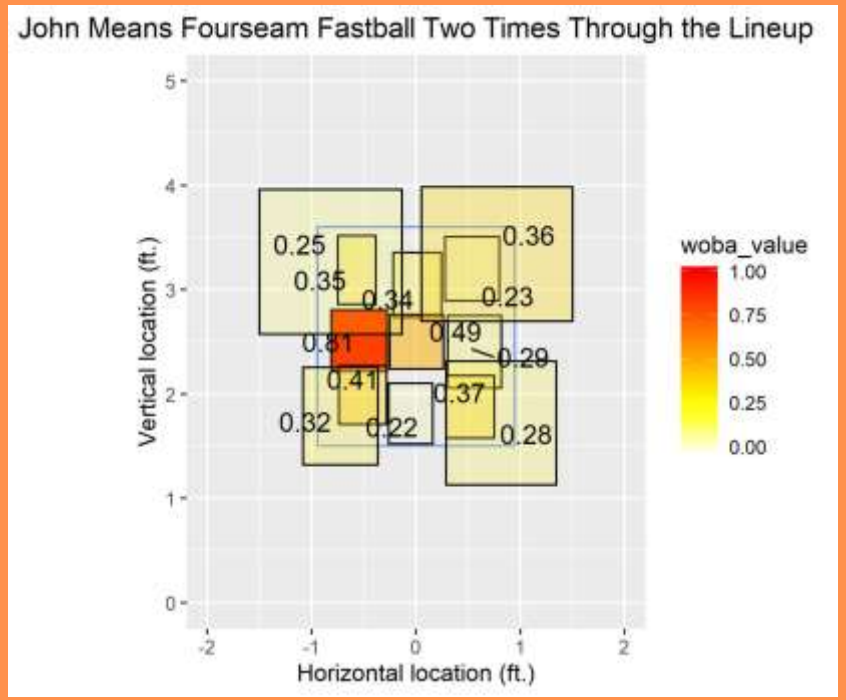


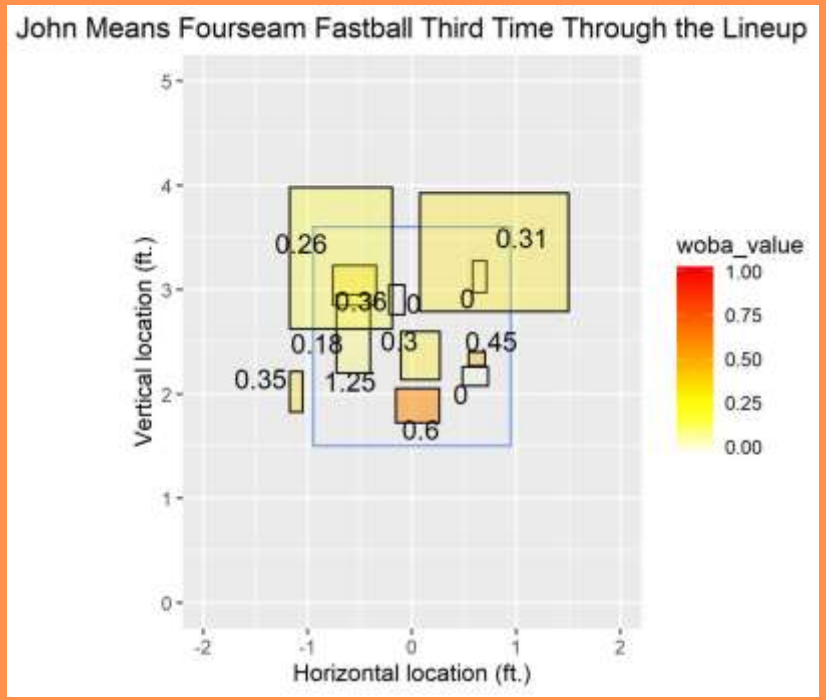
wOBA around or above average for almost every area within the strike zone

As expected, fastballs thrown in the middle of the strike zone have a greater woba

Pitches painting the strike zone tend to maintain a below average woba

John Means


John Means Fourseam Fastball Two Times Through the Lineup
Vertical location (ft.)
Horizontal location (ft.)
woba_value
1.00
0.75
0.50
0.25
0.00
0.25
0.35
0.34
0.36
0.23
0.49
0.29
0.41
0.37
0.32
0.22
0.28


John Means Fourseam Fastball Third Time Through the Lineup
Vertical location (ft.)
Horizontal location (ft.)
woba_value
1.00
0.75
0.50
0.25
0.00
0.26
0.31
0.36
0
0
0.18
0.3
0.45
0.35
1.25
0
0.6

Jacob deGrom

Team: New York Mets

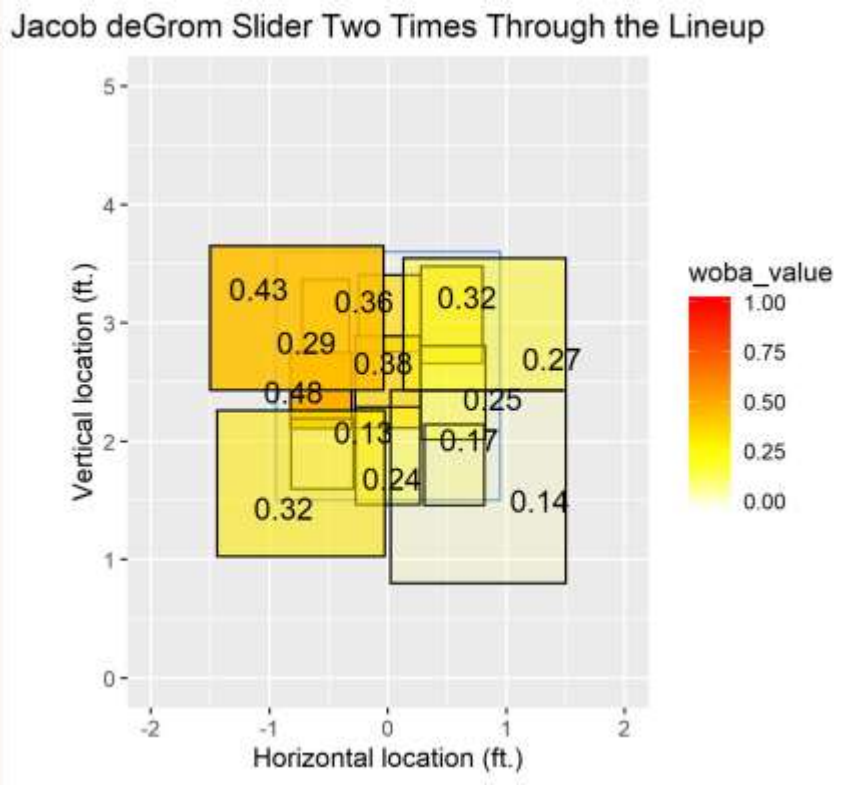
Hand: Right

Age: 31

Repertoire: FF, CH, SL

Jacob deGrom - Slider			
Statistics	1st-2nd	3rd	% change
Percent Thrown	30.015	36.31	20.97%
Isolated Power Against	0.0905	0.078	-13.81%
Whiff Percentage	20.645	18.29	-11.41%

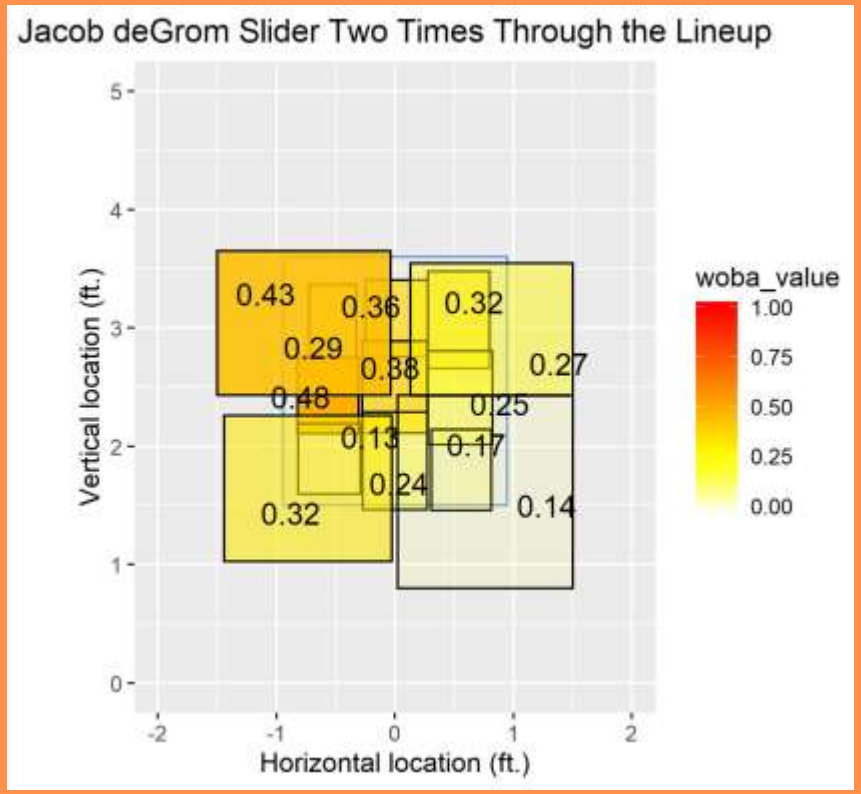
Jacob deGrom

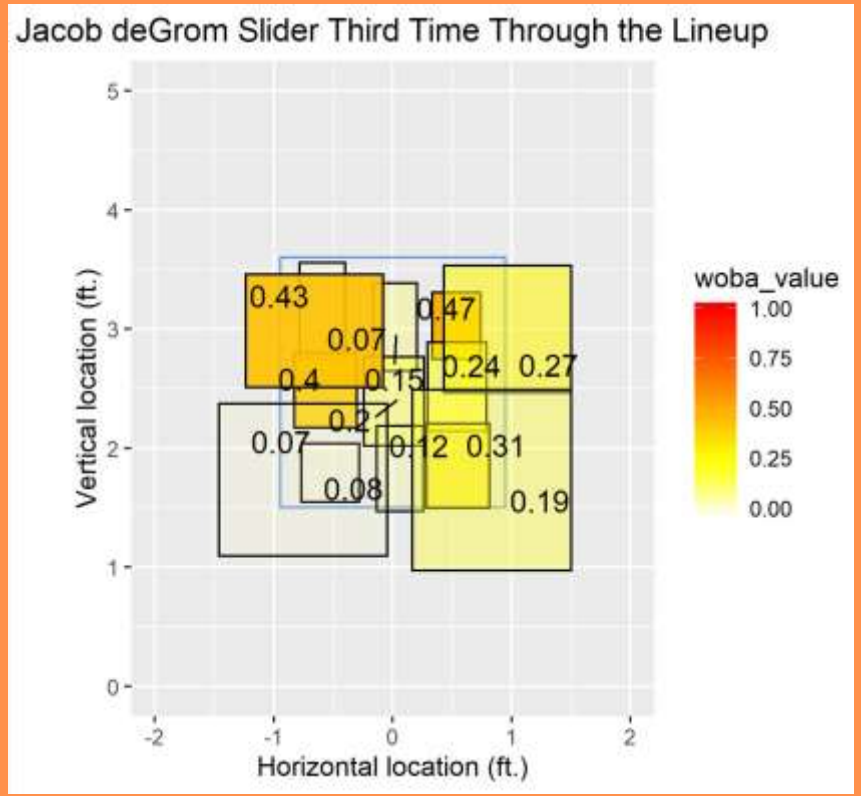


deGrom's slider woba below average across entire strike zone

As expected, the higher he misses in the zone the better batters do, however deGrom's slider does not regress in the same way that average pitchers do

Jacob deGrom





Contract Details

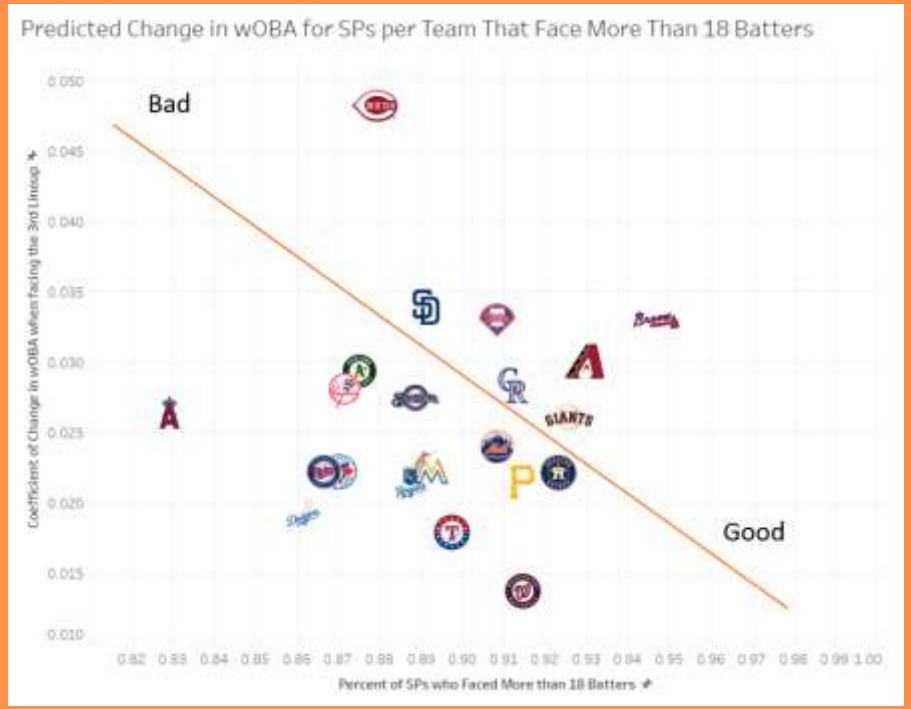
The key to success is value, and thus we wanted to find pitchers who would not break the bank.

Joe Musgrove - Currently under contract and has 2 years of arbitration left and will then become a free agent.

John Means - Currently under the pre-arbitration part of his contract.

Jeff Samardzija - Signed a 5 year 90 million deal in 2016. Currently in the last year of his contact.

Team Tendencies



We wanted to understand which teams have allowed pitchers to face a lineup for the third time, and if they were successful in doing so.

To analyze this we ran a regression that modelled the wOBA of starting pitchers for each team in the MLB when they face the lineup for the third time.

Summary

The type of pitches thrown by a pitcher heavily impacts how much worse they will get throughout a game, independent of talent. Pitches that rely on movement will regress the most, meaning pitchers should increase their percentage of fastballs thrown as their control declines. Team scouts should incorporate this information as a principle of their organization.

Team philosophies depend on their own roster breakdown, but limiting the percentage of sliders thrown late in game is universally better outside of elite arms. Teams should also be more concerned with movement than with velocity, as fastballs were found to regress less throughout the game no matter the speed.

The Secret Sauce: The Eephus?

While the sample size was too small to use, when pitchers threw an eephus the third time through the order the outcome of the event was significant and negative, meaning batters had very little success against it. Yu Darvish and Zack Greinke are the only players who occasionally throw an eephus in the league today.

Other Factors Considered

An important facet of our conclusion is we do not want to discourage pitchers from having a slider and throwing it early in games.

Another aspect we could have looked into was which pitchers almost never went three times through the order and regressed their data from the first to the second time through the order in order to predict their success the third time through.

Our pitch type models were not actually based on the top four pitches, since they were all types of fastball and thus not encompassing of an MLB pitcher's repertoire.

QUESTIONS?