



Syracuse University

Time for Pitchers to Changeup their Approach

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Evaluating the Prompt

- Deep pitching staff of players that don't marginally regress the third time through the order
 - Allow team to carry less pitchers
 - More flexibility in bullpen usage
- Investigate variables that allow pitchers to have relative success third time through
 - Pitch Arsenals and Pitch Types
 - Primary and Secondary Pitches
 - Contact Pitchers vs. Strikeout Pitchers
- Pinpoint identifying variables to locate pitchers who are successful the third time through
 - Strikeout and Walk Differences
 - Fatigue Effects and Saving Energy



Data and Methodology

- Collected 3rd time through the order game log data from FanGraphs from the last three seasons.
- Collected 1st and 2nd time through the order data and matched it to 3rd time through the order data
 - Only considered stats 1st and 2nd time through the order if they reached the 3rd time
- Matched this data with Statcast pitch arsenal and movement data



Data and Methodology



- Scraped Statcast for pitch by pitch data from the last three seasons (around 1.1 million rows)
 - Created new variables based on pitch count for when in the game a pitch was thrown
 - E.g. Pitches 0-9, 10-19, 20-29... 100+
 - Used these to find average spin rate and speed for each pitch in each “pitch cohort”



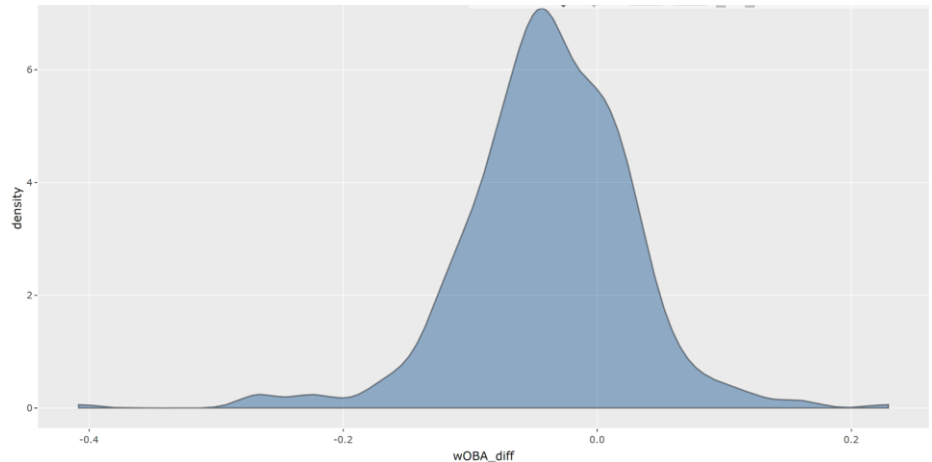
Data and Methodology

- How do we capture a drop-off or improvement in performance relative to each pitcher?
- Looked at wOBA against for our metric of evaluating each pitcher
 - Subtracted 3rd time through the order wOBA from 1st and 2nd time through the order wOBA
 - Minimum of 10 IP for 3rd time through
- Positive differences indicate improvement



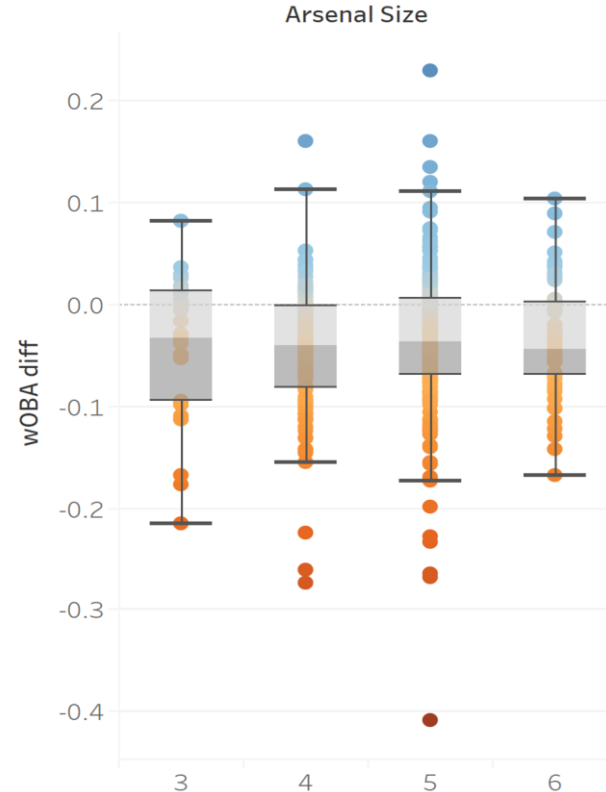
Best Actual wOBA Difference 3rd Time Through

- Rich Hill 2017 → .120
- Dan Straily 2018 → .111
- Mike Fiers 2017 → .090
- James Paxton 2018 → .082
- Trevor Williams 2019 → .066



Arsenal Size and wOBA Difference

- Arsenal size has little effect on wOBA difference
- Most variation occurs with an arsenal size of 5



Pitch Repertoire

wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	-0.0476	0.0052	-
Arsenal Size	0.0027	0.4533	-

Variables	Coefficients	P-Value	Confidence Level
Intercept	-0.0706	0.0003	-
Fourseam	0.0117	0.4246	-
Sinker	0.0078	0.2937	-
Cutter	-0.0007	0.9103	-
Slider	0.0032	0.645	-
Changeup	0.0127	0.1782	-
Curveball	0.0051	0.5489	-



Pitch Repertoire

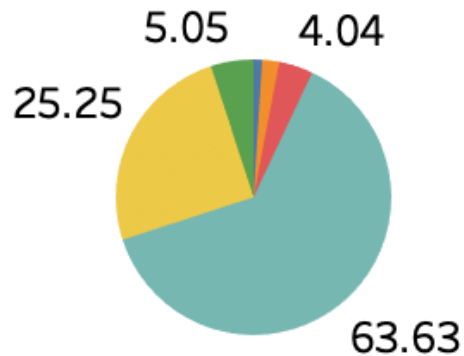
Logit Model
wOBA Difference Positive - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	0.1713	0.0074	-
Changeup and Curveball	0.13	0.0241	5%
Slider and Changeup	0.0705	0.2444	-
Slider and Curveball	-0.0697	0.2608	-
Fourseam and Sinker	-0.0072	0.8938	-



Pitch Percentages

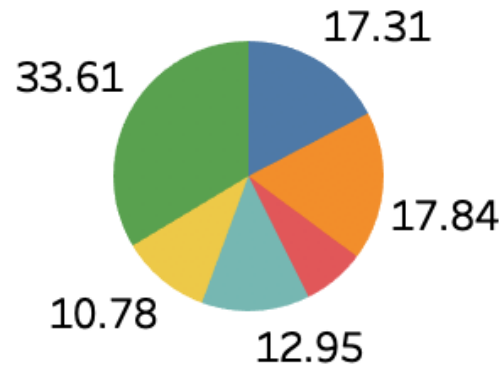
Primary Pitch Percentage



Measure Names

- Changeup
- Curveball
- Cutter
- Fourseam
- Sinker
- Slider

Secondary Pitch Percentage



Secondary Pitches

Logit Model wOBA Difference Positive - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	-0.0604	0.0008	-
Fourseam	0.0309	0.1147	-
Sinker	0.0275	0.1616	-
Cutter	0.0315	0.134	-
Slider	0.02721	0.1417	-
Changeup	0.0179	0.3543	-
Curveball	0.0242	0.2074	-



Fatigue Effects vs. Saving Energy for Later - Velocity

wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	0.0012	0.9407	-
Fourseam MPH Difference	0.0016	0.9417	-
Changeup MPH Difference	-0.0189	0.0879	10%
Curveball MPH Difference	-0.0045	0.6528	-
Cutter MPH Difference	-0.0176	0.093	10%
Slider MPH Difference	-0.0076	0.3308	-
Twoseam MPH Difference	-0.0065	0.5708	-



Fatigue Effects vs. Saving Energy for Later - Spin Rate

wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	0.0282	0.0525	-
Fourseam Spin Rate Difference	0.0002	0.5078	-
Changeup Spin Rate Difference	0	0.9384	-
Curveball Spin Rate Difference	0	0.4002	-
Cutter Spin Rate Difference	0.0002	0.0826	10%
Slider Spin Rate Difference	0	0.9871	-
Twoseam Spin Rate Difference	0	0.4529	-



Fatigue Effects vs. Saving Energy for Later

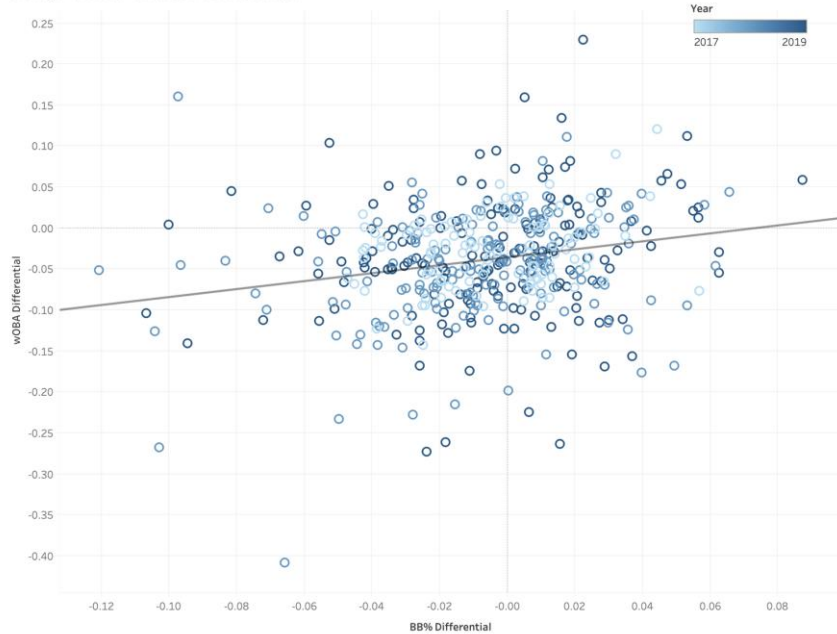
wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	0.0076	0.7225	-
Fourseam MPH Difference	-0.005	0.8631	-
Changeup MPH Difference	-0.0274	0.0951	10%
Curveball MPH Difference	-0.0137	0.4426	-
Cutter MPH Difference	-0.0132	0.3676	-
Slider MPH Difference	-0.0118	0.3679	-
Twoseam MPH Difference	0.0068	0.7668	-
Fourseam Spin Rate Difference	0.0006	0.1242	-
Changeup Spin Rate Difference	0.0001	0.5443	-
Curveball Spin Rate Difference	0	0.9752	-
Cutter Spin Rate Difference	0.0001	0.4078	-
Slider Spin Rate Difference	-0.0002	0.3788	-
Twoseam Spin Rate Difference	-0.0002	0.4292	-

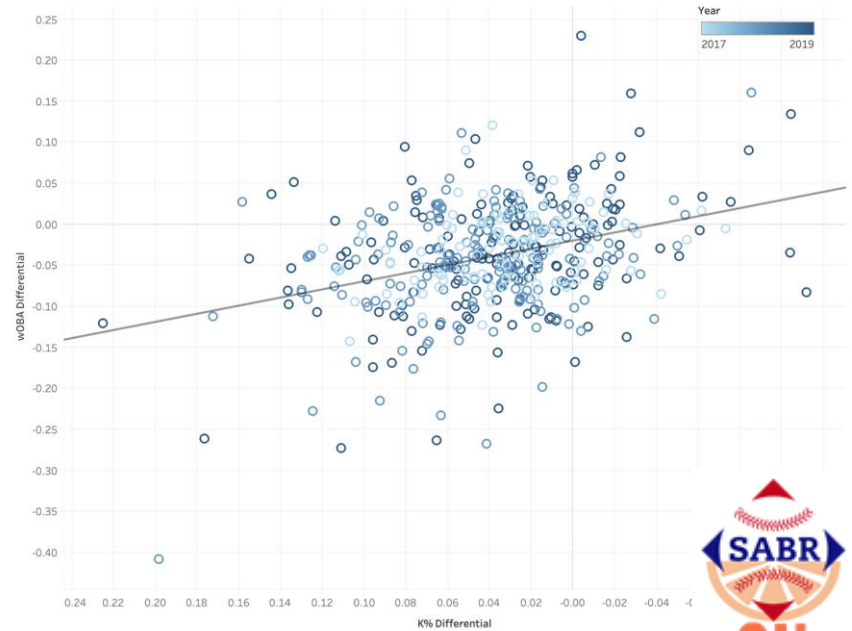


K% and BB% on wOBA Differential

Change in BB% on wOBA Differential



Change in K% on wOBA Differential



K% and BB%

wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	-0.0146	0.3766	-
K pct	0.0398	0.4559	-
BB pct	-0.2117	0.1264	-
K pct difference	-0.3273	0	1%
BB pct difference	0.3388	0.0007	1%



BB% vs. K% Difference



- Negative K% difference indicates increase third time through
- Positive BB% difference indicates decrease 3rd time through



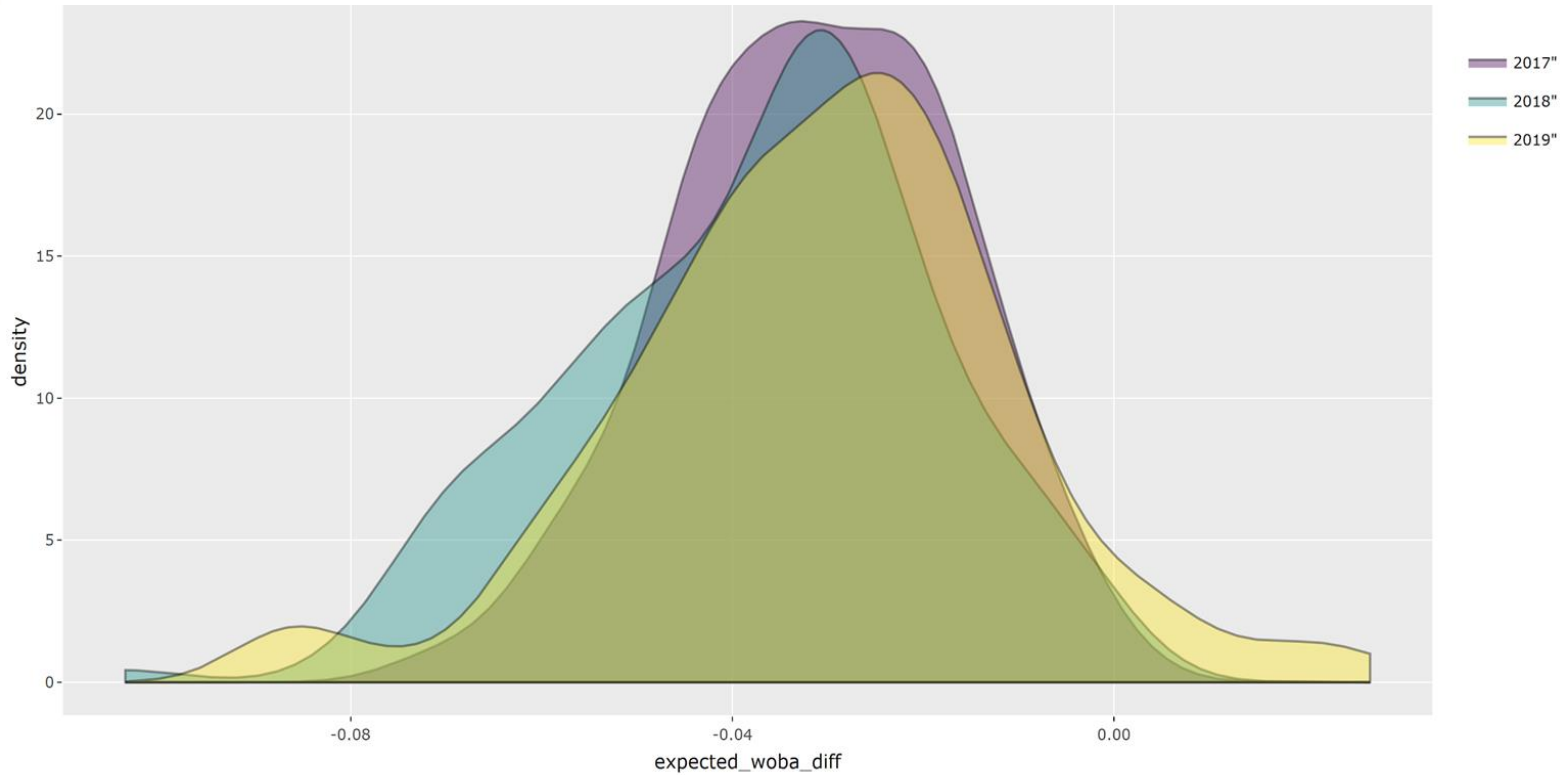
Prediction Model for Expected wOBA Difference

wOBA Difference - Dependent Variable

Variables	Coefficients	P-Value	Confidence Level
Intercept	-0.0241	0.0031	-
Changeup MPH Difference	-0.004	0.2547	-
K pct Difference	-0.3096	0	1%
BB pct Difference	0.3706	0.0004	1%
Changeup and Curveball	0.0077	0.3551	-



Expected wOBA Difference Distribution



Criteria for Player Selection

- Identified pitchers that were not given ample opportunity to pitch the third time through the order
- Less than 20% of batters faced against the third time through the line up
- Used our model for expected wOBA difference
- Only considered players for the 2019 season as candidates



Brad Peacock - Astros



- Reliever in 2018, but started 15 games in 2019
- 5 Pitches in his arsenal (FF, SI, SL, CU, CH)
- Proj. wOBA decrease of 0.0581 third time through
- Faced just 13.87 batters per appearance
- 2.2% K% increase third time through
- 8.7% BB% decrease third time through
- Only 0.8625 MPH decrease in changeup velocity from cohort 1 to 8



Peter Lambert - Rockies

- Called up to Rockies due to injuries in 2019
- Actual: wOBA increase of 0.0833 third time through
- Model: wOBA decrease of 0.0215 third time through
- Walked 2% less batters the third time through the lineup per batter faced
- Struck out 11% more batters third time through
- Curveball and Changeup combination



Dillon Peters - Angels



- 3rd year pitcher
- Proj. wOBA difference of .0201 third time through
- Fastball spin rate increases 35 rpm between cohort 1 and 8
- Changeup mph drops only .5 mph
- K% up 11% third time through
- Changeup Curve combination



Gio Gonzalez - White Sox

- Lefty Milwaukee Brewers SP in 2019, started with Yankees on MiLB Deal.
- Not a normal Spring Training in 2019, resulted in Injured List appearance due to “Dead Arm”
- Proj. 0.1121 wOBA decrease 3rd time through
- 16.22 Batters Faced per appearance
- 28.08 Changeup Spin Rate increase
- 3% K increase third time through
- 5.3% BB decrease third time through



Griffin Canning - Angels

- Rookie pitcher in 2019
- Proj. wOBA decrease of .0039 third time through
- Minimal decrease in wOBA 3rd time through
- Struck out 5% more batters 3rd time through
- Walked 4% less batters 3rd time through
- Changeup Curveball combination



Risk and Data Assessment

- Cannot account for whether they save certain pitches for later
- Could not statistically test certain strategies
 - Wanted the data for the approach of each game
- Had to assume health while they were pitching
- Cannot statistically look at pitch accuracy decline throughout the game because intended locations are not known



Conclusion - Applying the Culture

- We recommend the development of a curveball and changeup in young pitchers while in the minors
- Success can be easily identified but reasons for success is most likely in-game-strategy based and not based on pitcher archetypes or developmental characteristics
- Commonly thought factors including fastball velocity drop off and arsenal size are not significant in wOBA difference

