

Quantifying The Effect of Pitching Metrics

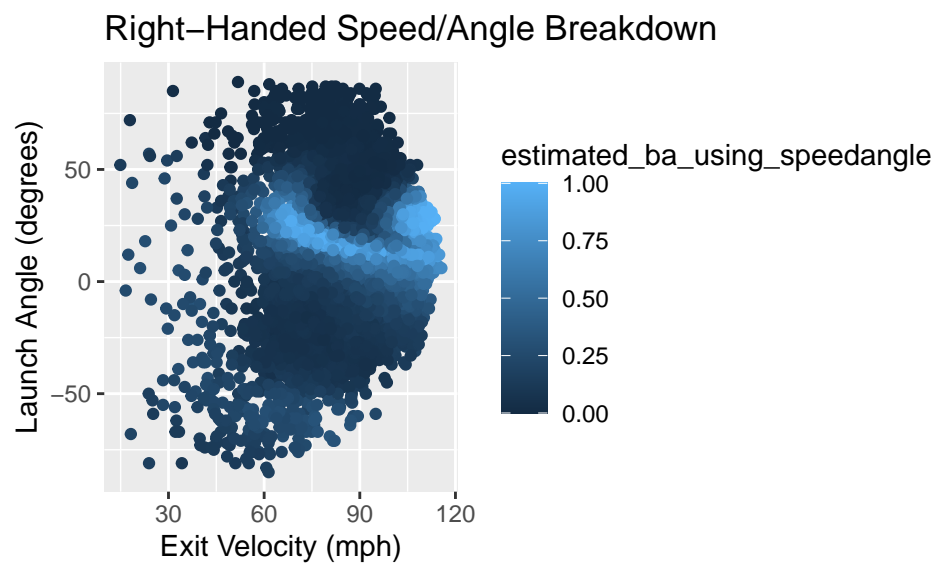
Max Brown

May 20, 2022

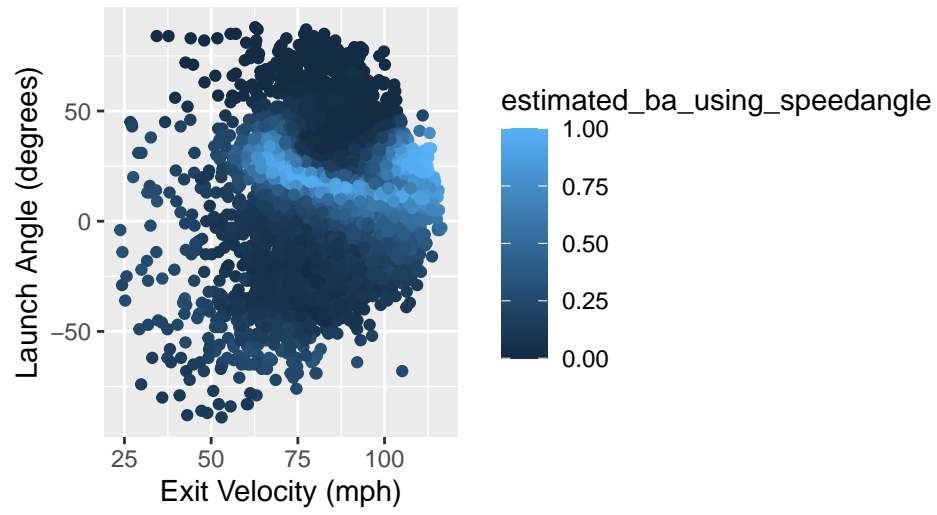
Introduction

The methodology of analyzing the performance of pitchers has drastically changed over time. At the surface one can evaluate a pitcher's win-loss record to determine their impact on the team's performance. It's a results-based model, but includes several factors far out of a pitcher's control, fundamentally the

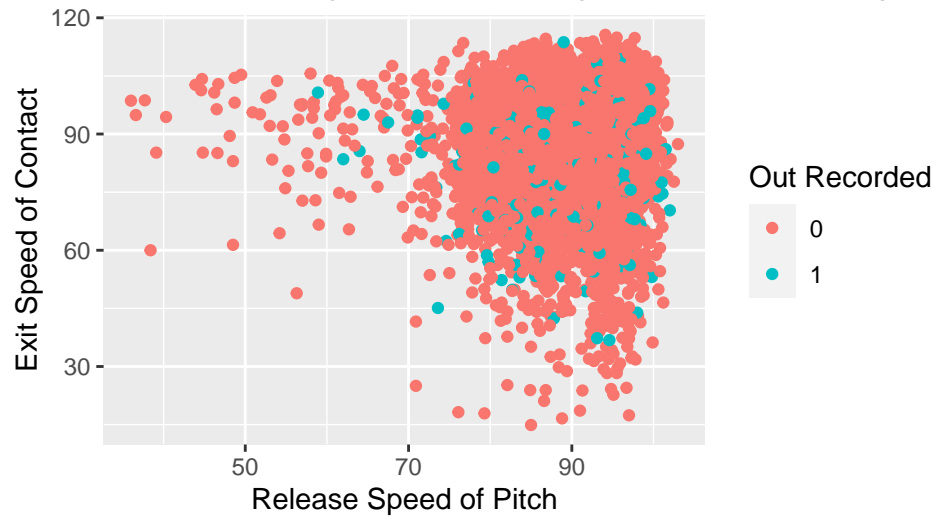
General EDA



Left-Handed Speed/Angle Breakdown

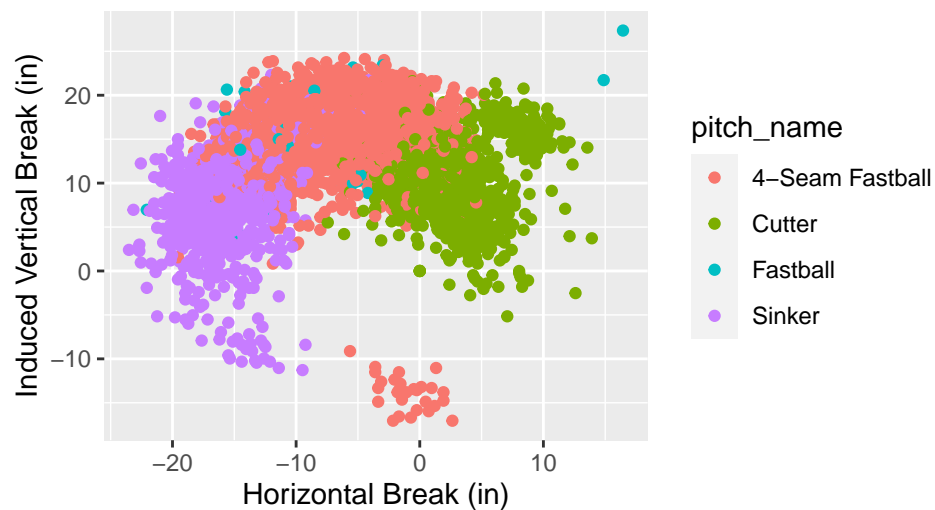


No Relationship For Release Speed and Launch Speed/



Fastball EDA

Right-Handed Fastball Breakdown



Left-Handed Fastball Breakdown

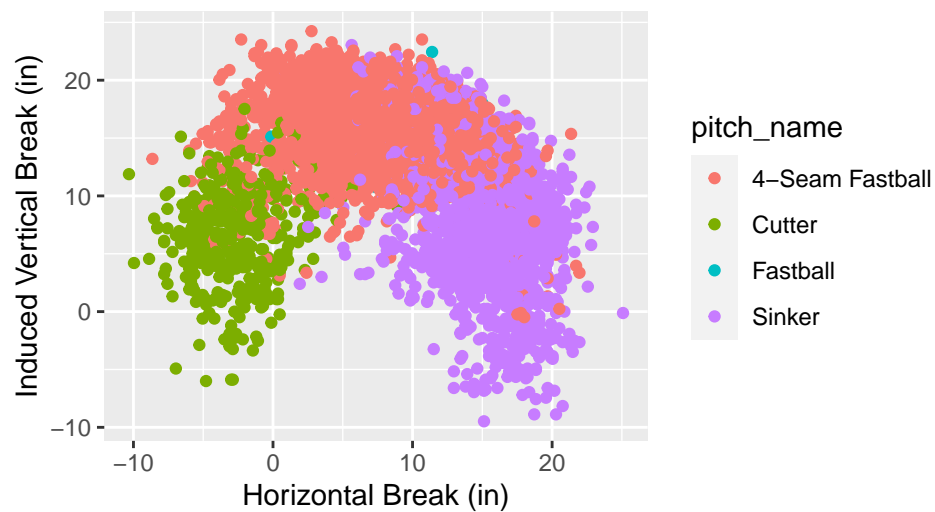


Table 1: Average RH Fastball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
4-Seam Fastball	94.89	2304.33	-7.28	16.00	213.42
Cutter	91.86	2412.12	2.96	10.82	180.17
Fastball	69.79	1703.67	-8.79	15.02	221.85
Sinker	94.65	2167.59	-14.87	9.15	223.31

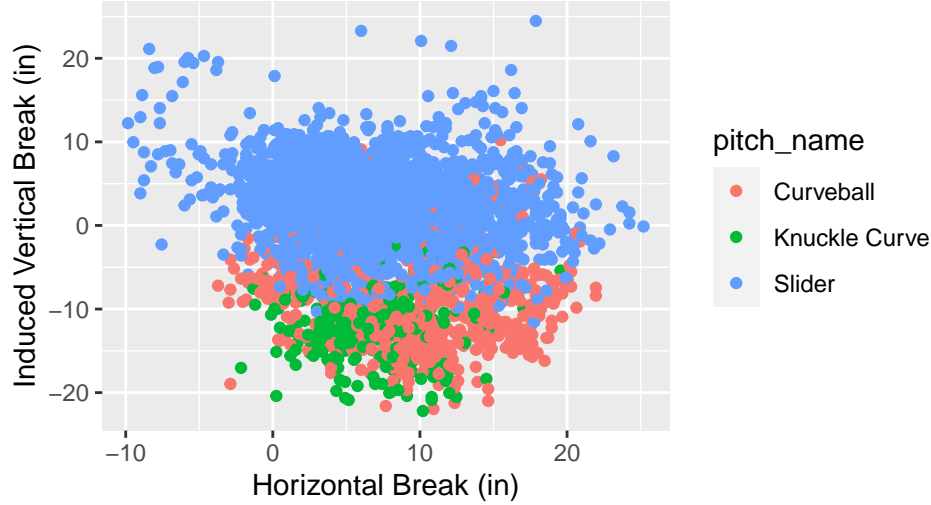
Table 2: Average LH Fastball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
4-Seam Fastball	93.78	2288.18	7.36	16.04	150.43

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Cutter	88.41	2377.43	-2.67	6.82	189.76
Fastball	65.52	1708.58	7.61	15.01	134.47
Sinker	93.70	2137.25	14.34	9.54	129.77

EDA Breaking Balls

Right-Handed Breaking Ball Breakdown



Left-Handed Breaking Ball Breakdown

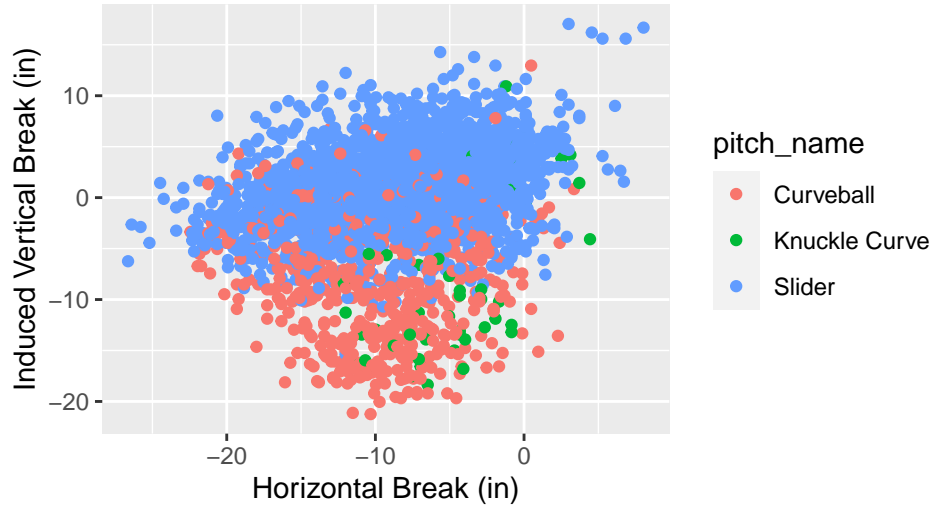


Table 3: Average RH Breaking Ball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Curveball	80.03	2591.57	10.05	-9.54	41.78
Knuckle Curve	82.49	2489.44	6.79	-11.70	33.16
Slider	85.19	2422.75	6.58	2.16	110.67

Table 4: Average LH Breaking Ball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Curveball	78.15	2447.33	-10.12	-8.13	310.40
Knuckle Curve	80.13	2259.08	-4.30	-7.36	283.60
Slider	83.20	2422.00	-8.47	1.17	260.14

EDA Change Ups

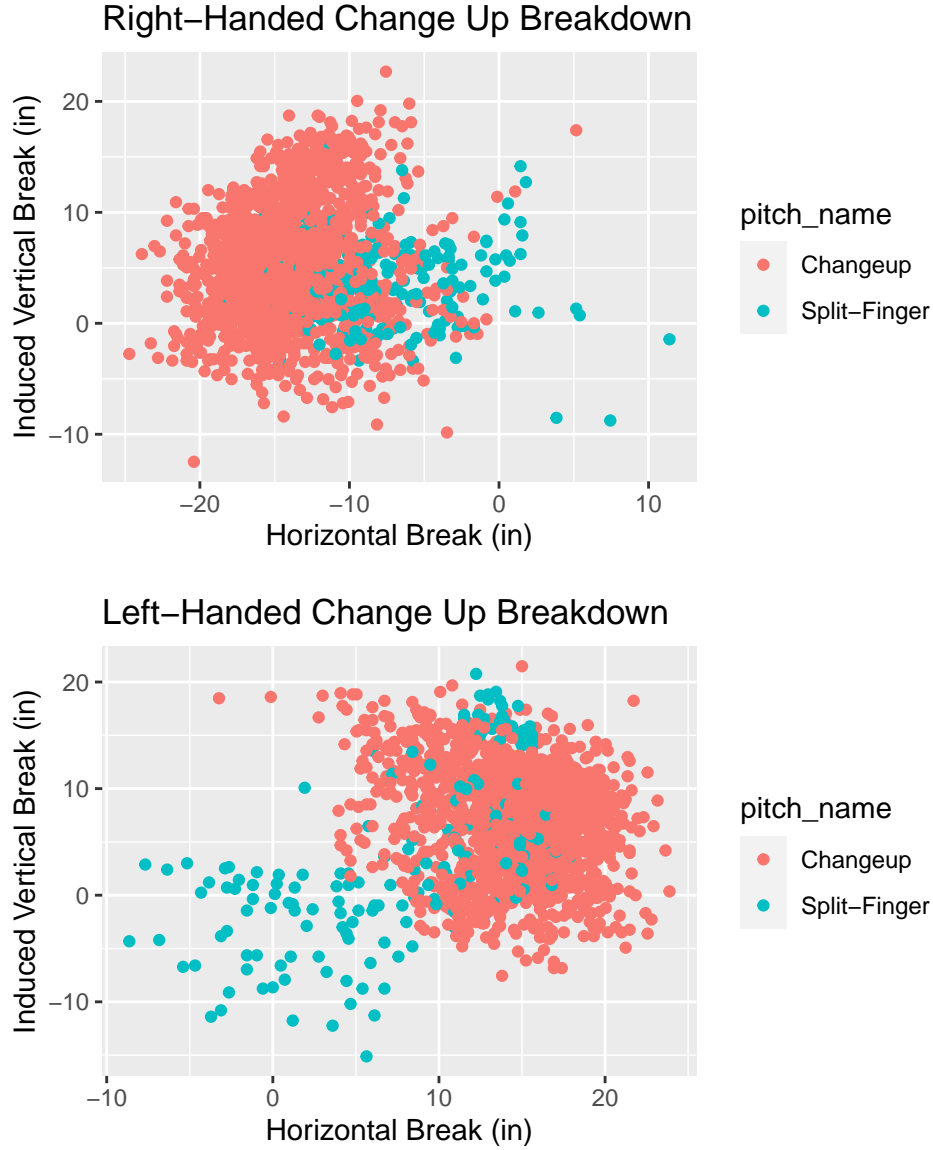


Table 5: Average RH Change Up Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Changeup	86.01	1807.24	-14.04	5.51	240.19

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Split-Finger	86.84	1162.40	-8.58	3.66	236.59

Table 6: Average LH Change Up Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Changeup	84.24	1833.81	14.62	6.90	117.86
Split-Finger	85.21	1241.81	8.23	3.85	127.06

Methodology

Creating Breaking Ball Models

Right-Hand

term	estimate	std.error	statistic	p.value
(Intercept)	-0.172	0.789	-0.218	0.827
release_speed	0.005	0.009	0.602	0.547
hor_break	0.003	0.007	0.435	0.664
ind_vert_break	0.015	0.005	2.768	0.006
mean_centered_axis	0.000	0.001	0.077	0.938

term	estimate	std.error	statistic	p.value
(Intercept)	0.315	0.036	8.739	0.000
ind_vert_break	0.014	0.005	2.925	0.003

Left-Hand

term	estimate	std.error	statistic	p.value
(Intercept)	0.566	1.071	0.528	0.597
release_speed	-0.005	0.013	-0.402	0.688
hor_break	-0.013	0.007	-1.778	0.075
ind_vert_break	0.006	0.008	0.741	0.459
mean_centered_axis	0.000	0.001	0.184	0.854

Creating Change Up Models

Right-Handed

term	estimate	std.error	statistic	p.value
(Intercept)	-0.833	1.168	-0.714	0.475
release_speed	0.010	0.014	0.748	0.455
hor_break	-0.005	0.011	-0.407	0.684
ind_vert_break	0.005	0.009	0.536	0.592

term	estimate	std.error	statistic	p.value
mean_centered_axis	0.002	0.004	0.462	0.644

Left-Handed

term	estimate	std.error	statistic	p.value
(Intercept)	0.078	1.154	0.067	0.946
release_speed	0.002	0.013	0.183	0.855
hor_break	-0.009	0.011	-0.824	0.410
ind_vert_break	-0.001	0.009	-0.093	0.926
mean_centered_axis	0.000	0.002	-0.205	0.837

Creating RH Fastball Models

RH Sinker

term	estimate	std.error	statistic	p.value
(Intercept)	-1.430	2.061	-0.694	0.488
release_speed	0.019	0.022	0.847	0.397
hor_break	-0.006	0.021	-0.283	0.777
ind_vert_break	0.001	0.013	0.040	0.968
mean_centered_axis	0.003	0.009	0.297	0.766

RH 4-Seam Fastball

term	estimate	std.error	statistic	p.value
(Intercept)	0.475	1.263	0.376	0.707
release_speed	-0.008	0.014	-0.605	0.545
hor_break	-0.010	0.008	-1.237	0.216
ind_vert_break	0.040	0.009	4.296	0.000
mean_centered_axis	0.000	0.006	-0.043	0.966

term	estimate	std.error	statistic	p.value
(Intercept)	-0.186	0.142	-1.310	0.19
ind_vert_break	0.037	0.009	4.237	0.00

RH Cutter

term	estimate	std.error	statistic	p.value
(Intercept)	-5.176	3.256	-1.589	0.112
release_speed	0.063	0.037	1.693	0.090
hor_break	0.033	0.021	1.536	0.125
ind_vert_break	-0.014	0.020	-0.730	0.465
mean_centered_axis	0.002	0.006	0.401	0.689

Creating LH Fastball Models

LH Sinker

term	estimate	std.error	statistic	p.value
(Intercept)	-1.078	1.748	-0.617	0.537
release_speed	0.017	0.019	0.883	0.377
hor_break	-0.006	0.018	-0.320	0.749
ind_vert_break	0.003	0.012	0.224	0.823
mean_centered_axis	-0.005	0.004	-1.140	0.254

LH 4-Seam Fastball

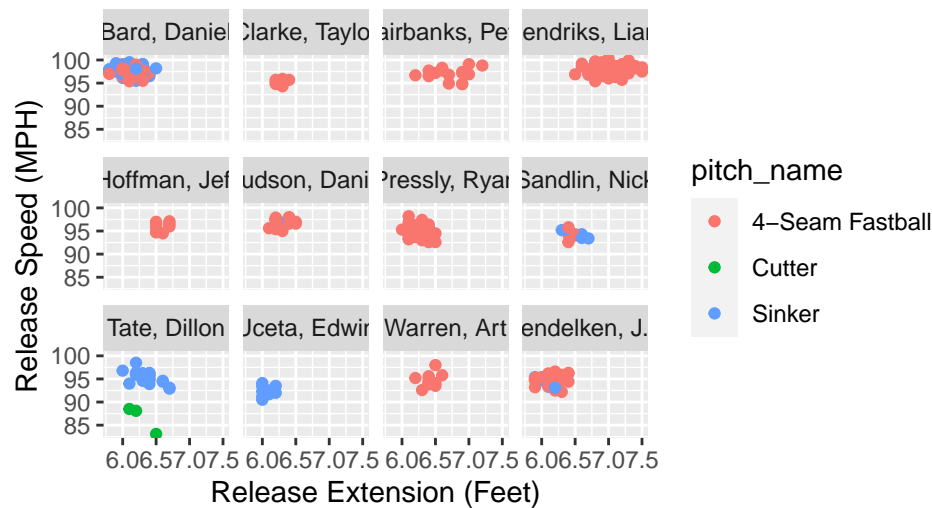
term	estimate	std.error	statistic	p.value
(Intercept)	-0.498	1.367	-0.365	0.715
release_speed	0.004	0.015	0.310	0.757
hor_break	-0.007	0.009	-0.749	0.454
ind_vert_break	0.028	0.013	2.218	0.027
mean_centered_axis	0.002	0.005	0.479	0.632

LH Cutter

term	estimate	std.error	statistic	p.value
(Intercept)	0.836	3.338	0.250	0.802
release_speed	-0.006	0.038	-0.151	0.880
hor_break	-0.023	0.039	-0.586	0.558
ind_vert_break	-0.023	0.027	-0.835	0.404
mean_centered_axis	0.004	0.003	1.379	0.168

Appendix

Inconclusive Evidence of Righty Extension/Speed Relati



Inconclusive Evidence of Lefty Extension/Speed Relation

