The Single to Right Field: Why lefties in the MLB might be underpaid
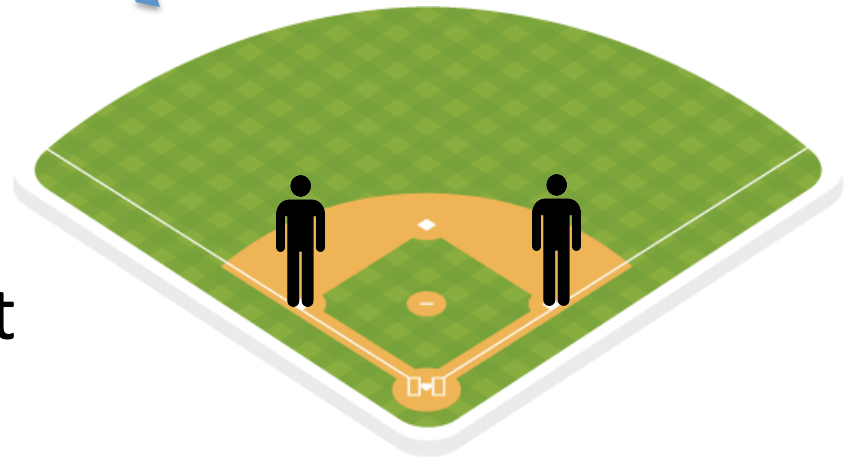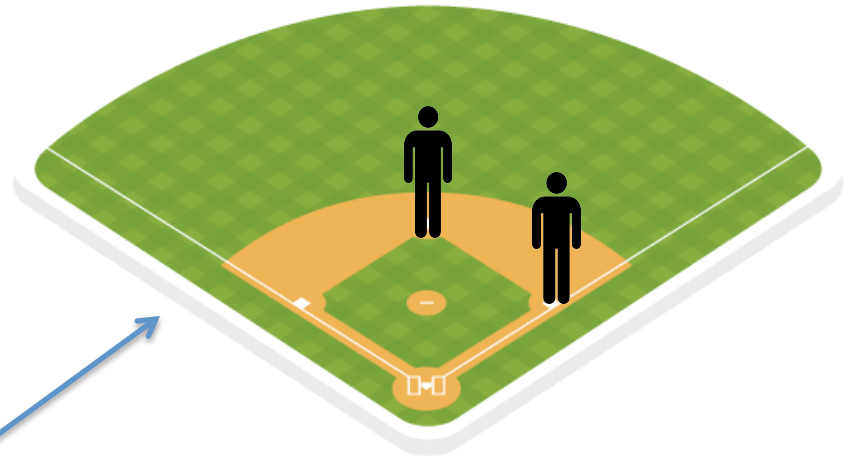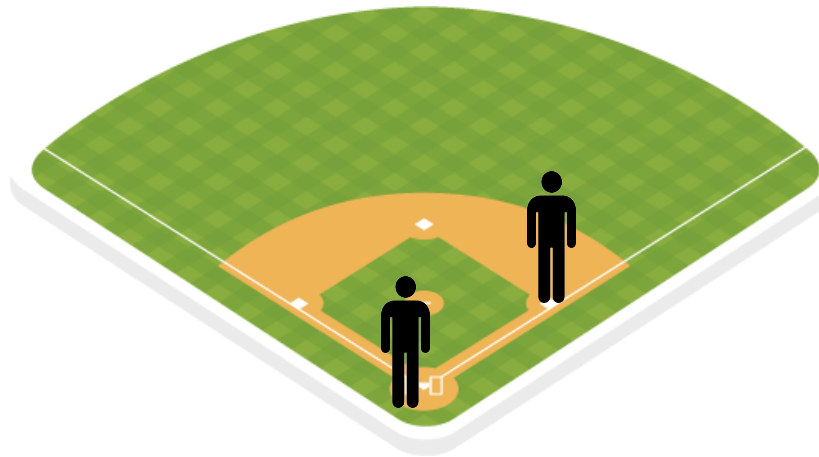
Daniel Allen

Quick Primer - WAR

- Wins Above Replacement (WAR): A player's total contributions to their team, expressed in wins
- Value of 1 WAR: $7 million
- Mike Trout, 2014 season: 7.8 WAR
- A single is given equal value for all situations in calculations of WAR by Fangraphs, Baseball Reference, and Baseball Prospectus
  - Does this make sense?

Before

After

Single with Runner on First

Before

After

5% of all plate appearances
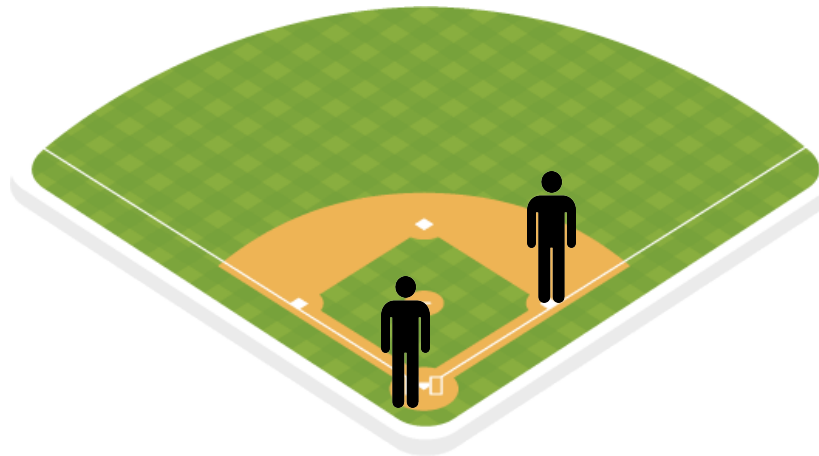
72%
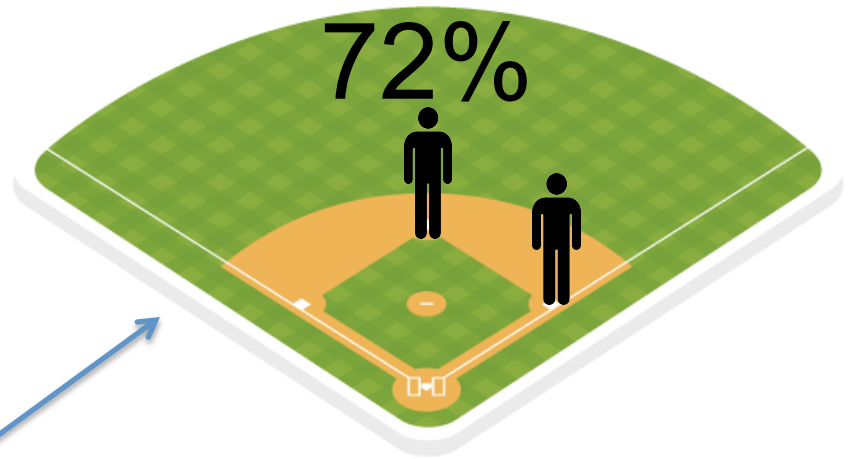
28%
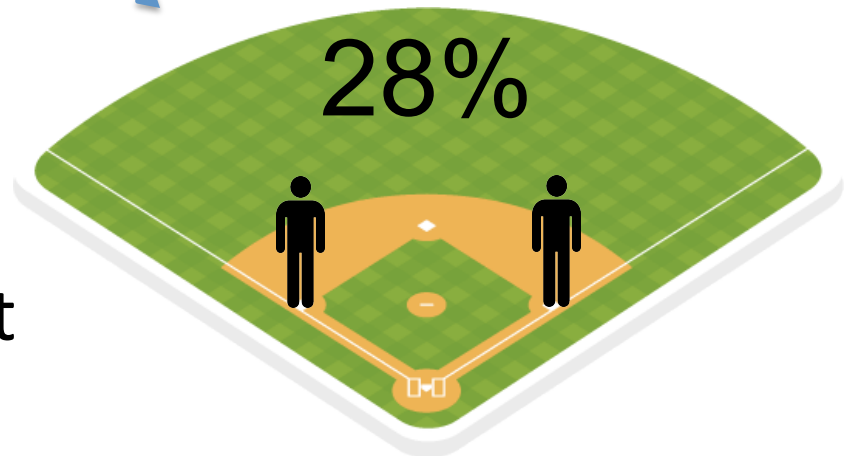
Single with Runner on First
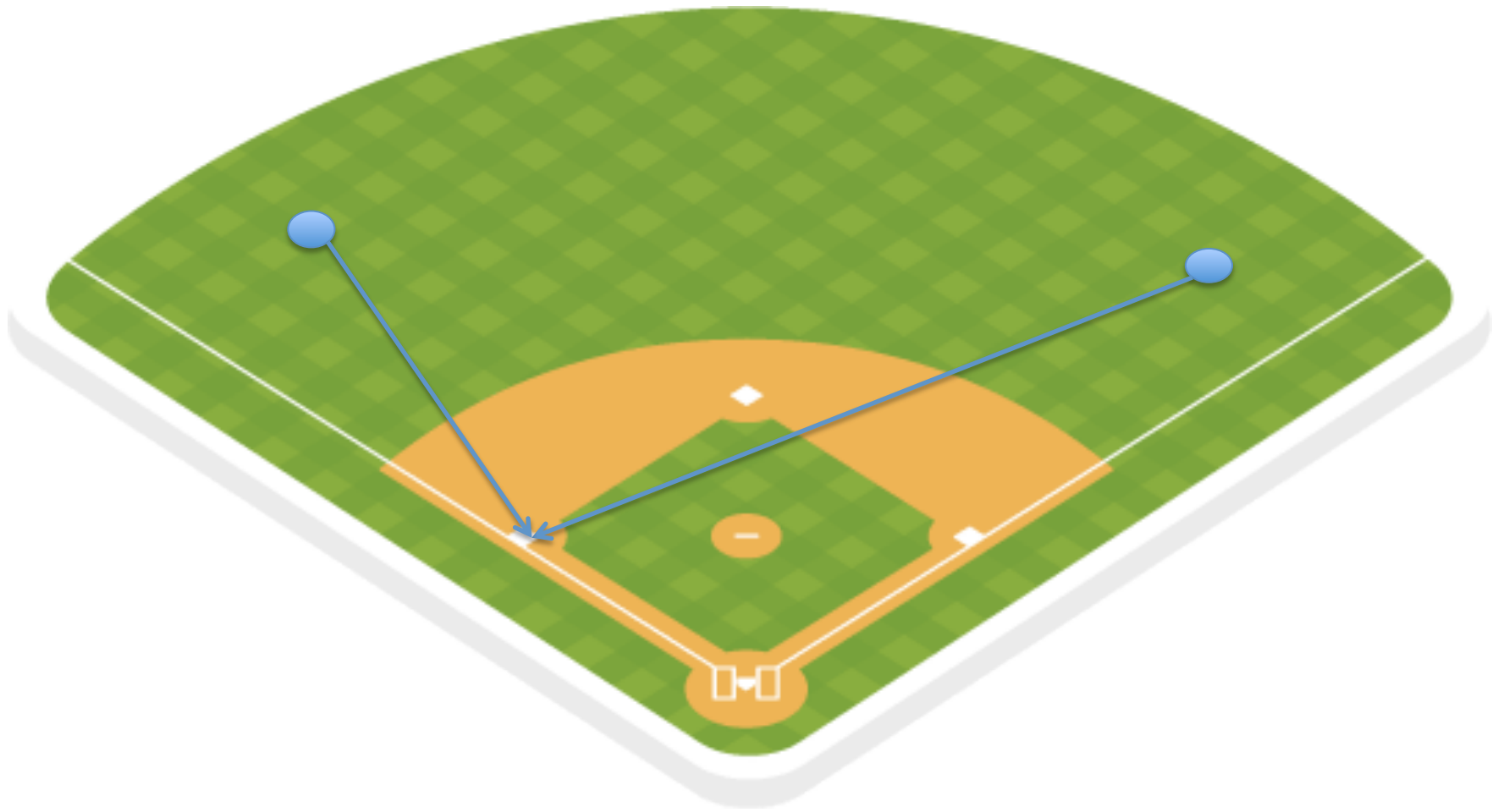
Chris Carter: Hit Type
Seasons: 2012 to 2014
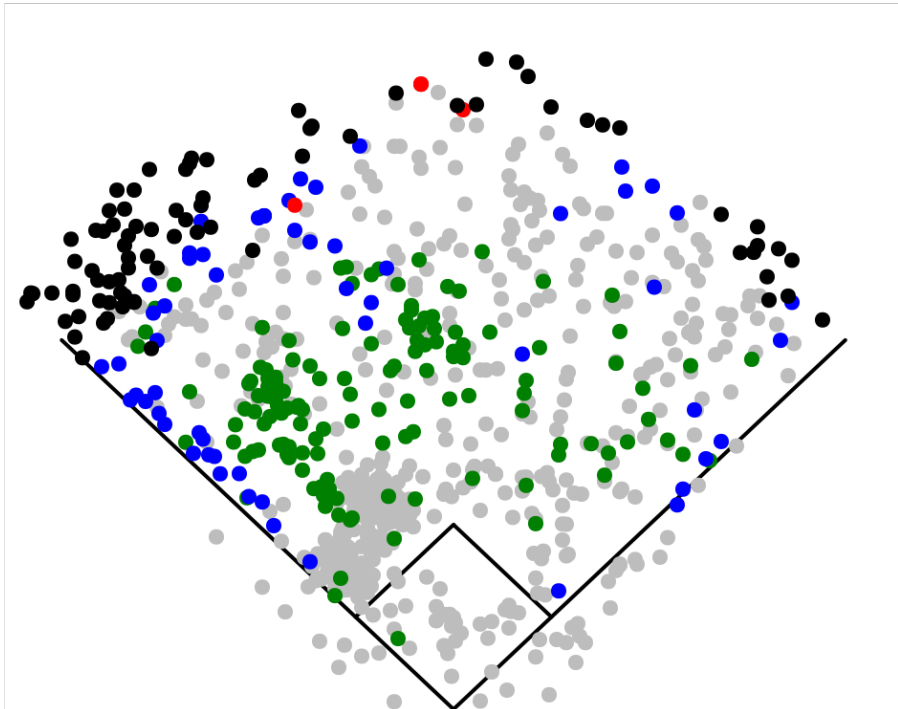
Lucas Duda: Hit Type
Seasons: 2012 to 2014

Out   Single   Double   Triple   Home Run
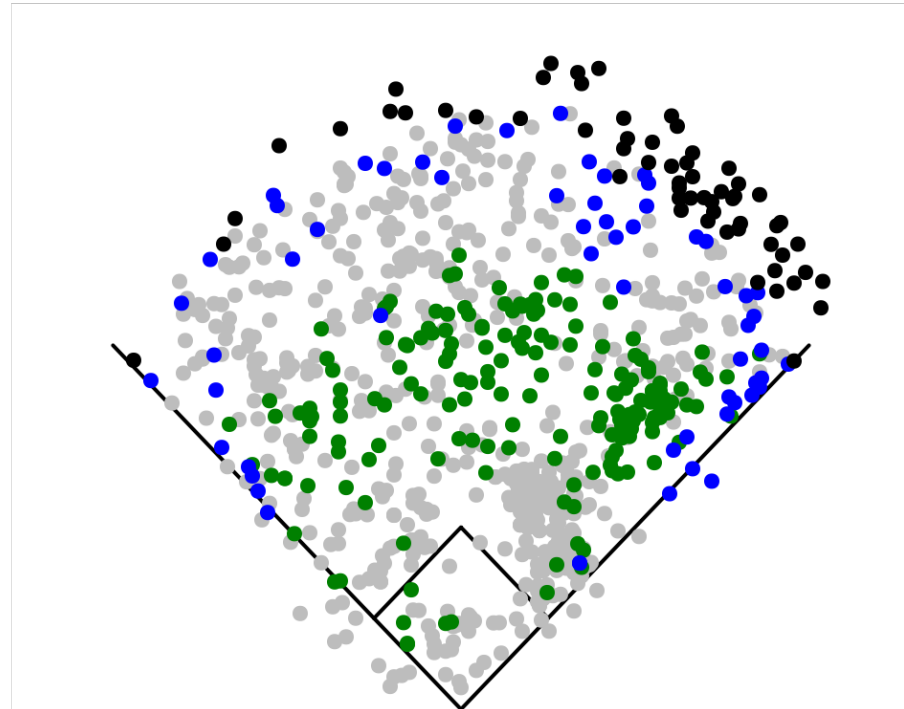
Out   Single   Double   Triple   Home Run

Are lefties more likely than righties to advance the runner?

- Probably. Lefties are more likely to hit the ball to right field, so it takes more time on a given single for the fielder to get the ball to third base
- But by how much? Is it significant?

Quick Primer - NERV

Net Expected Run Value

		Runners							
		None On	1st	2nd	3rd	1st, 2nd	1st, 3rd	2nd, 3rd	Bases loaded
Number of Outs	0	.51	.85	1.11	1.3	1.39	1.62	1.76	2.15
	1	.27	.51	.68	.94	.86	1.11	1.32	1.39
	2	.10	.23	.31	.38	.42	.48	.52	.65

Before
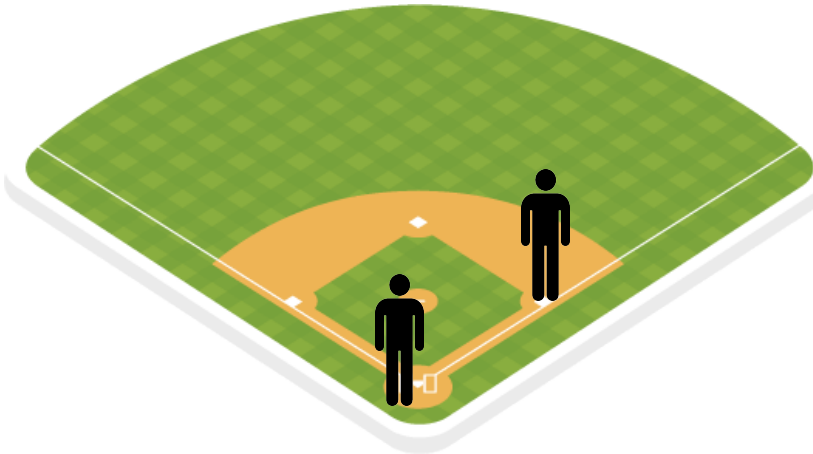
After

Single with Runner on First
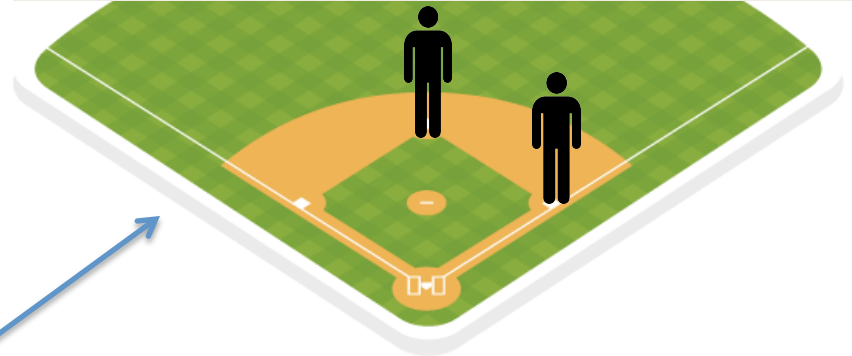
Quick Primer – WE and WPA

- Win Expectancy (WE): % chance the batting team wins the game—based on NERV table
- Win Probability Added (WPA): increase in WE on a given play – like wWPA, but this is bWPA.

3/30/2008 – Braves(2) @ Nationals(3)

M Prado Passed Ball

R Zimmerman Home Run

M Teixeira Double

Nationals

Braves

Batter	AB	R	H	HR	RBI	BB	SO	pLI	WPA
R Zimmerman	4	1	1	1	1	0	1	0.87	.388
A Kearns	3	0	1	0	1	0	0	0.73	.060
N Johnson	3	1	1	0	1	0	0	0.97	.056
C Guzman	4	1	1	0	0	0	1	1.20	-.006

1   2   3   4   5   6   7   8   9
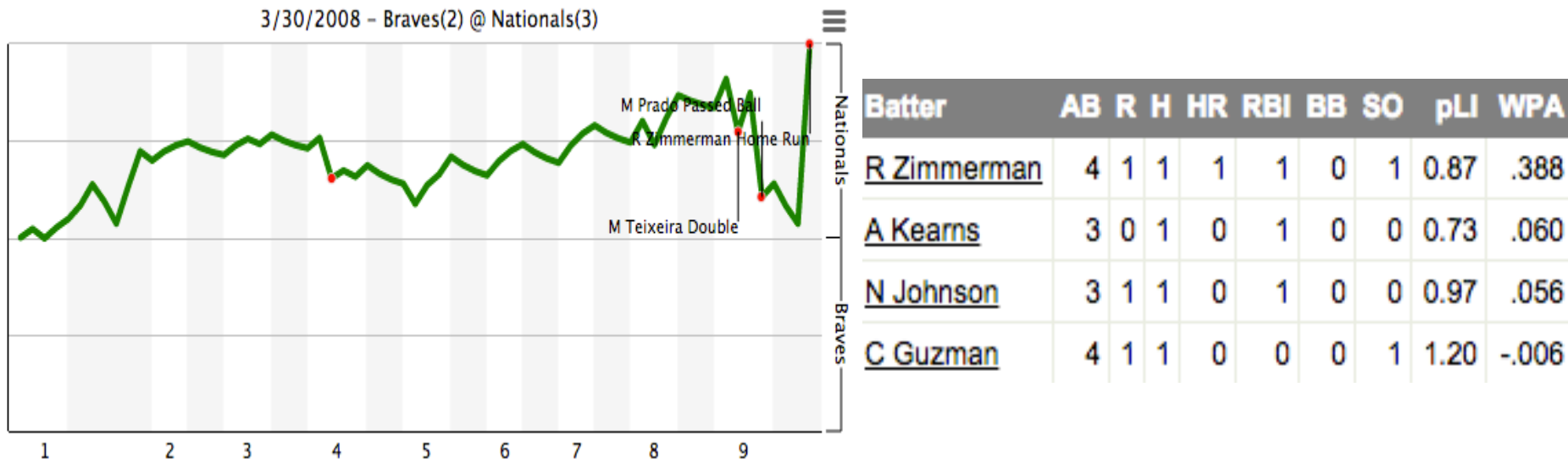
Quick Primer – WE and WPA

- Why isn't WPA used instead of WAR?
  - While WPA is a precise historical statistic that tells us exactly how much each player contributed to their team, it is not as good an indicator as WAR of real talent or predicted success.
  - WAR is a better predictor of WPA than WPA itself

Average Win Probability Added on a single

- No man on first: .034 (3.4%)
- Man on first: .059 (5.9%)
- Man on first, advances to second: .051 (5.1%)
- Man on first, advances to third: .076 (7.6%)
- "Wins" added by advancing the runner to third instead of second: .076 − .051 = **.025**, or 1/40 of a win

Important Numbers

- P_{batter}: Batter's historical probability to advance the runner to third base

- P_{runner}: Runner's historical probability to advance to third base

- 5

Highest P$_{batter}$ of the 90's and 00's

| Batter	1B makes it to 3B	Batter	1B makes it to 3B
Jim Edmonds	0.481727575	Carlos Beltran	0.418269231
Dave Magadan	0.477876106	Jeromy Burnitz	0.416666667
Bobby Higginson	0.459854015	Barry Bonds	0.416666667
Mo Vaughn	0.453038674	Ken Griffey, Jr.	0.413202934
Mark Grace	0.444444444	Jim Thome	0.411392405
Rafael Palmeiro	0.442831216	Todd Walker	0.410788382
Todd Helton	0.435215947	Fred McGriff	0.408730159
Tony Gwynn	0.433255269	Wally Joyner	0.405797101
Will Clark	0.43220339	Larry Walker	0.403100775
Carlos Delgado	0.431818182	Jason Giambi	0.401869159
Rusty Greer	0.431095406	Kirby Puckett	0.400809717
Harold Baines	0.426035503	Cliff Floyd	0.399141631
Eddie Murray	0.423791822	Garrett Anderson	0.398268398
Cecil Fielder	0.423236515	J.T. Snow	0.395348837
Darrin Fletcher	0.421940928	Chipper Jones	0.394444444

Lowest P~batter~ of the 90's and 00's

Batter	1B makes it to 3B	Batter	1B makes it to 3B
Benito Santiago	0.157738095	Kenny Lofton	0.221288515
Otis Nixon	0.157894737	Gary Gaetti	0.223076923
Reggie Sanders	0.159851301	Rich Aurilia	0.227891156
Luis Castillo	0.172248804	Brian Jordan	0.229607251
Scott Brosius	0.184466019	Nomar Garciaparra	0.231060606
Wil Cordero	0.1886121	Juan Encarnacion	0.237864078
Ed Sprague	0.193069307	Andruw Jones	0.237918216
Bernard Gilkey	0.199095023	Ron Gant	0.238493724
Raul Mondesi	0.202531646	Deivi Cruz	0.240143369
Tony Womack	0.205479452	Magglio Ordonez	0.24137931
Miguel Tejada	0.207746479	Marquis Grissom	0.243735763
Doug Glanville	0.212871287	Javy Lopez	0.244147157
Craig Biggio	0.213483146	Jose Guillen	0.245192308
Greg Vaughn	0.217857143	Glenallen Hill	0.245901639
Jay Buhner	0.219409283	Jeff Cirillo	0.246376812

How can we isolate the batter's "true" tendency to advance the average runner to third base?

- Calculate batter's average runner's P_{runner}. i.e. Average P_{runner} over all the batter's singles with a runner on first. Let's call this $P_{batterrunner}$

- $P_{batterrunner}(i)$ is basically the average "skill" of the runners for batter i.

- Calculate difference between P_{batter} and $P_{batterrunner}$: this represents the factor unaccounted for by the runner

- Dataset: All MLB plays since 1920, looking at the 1494 batters with a sample size ≥ 100

P~batter~ vs. P~batterrunner~
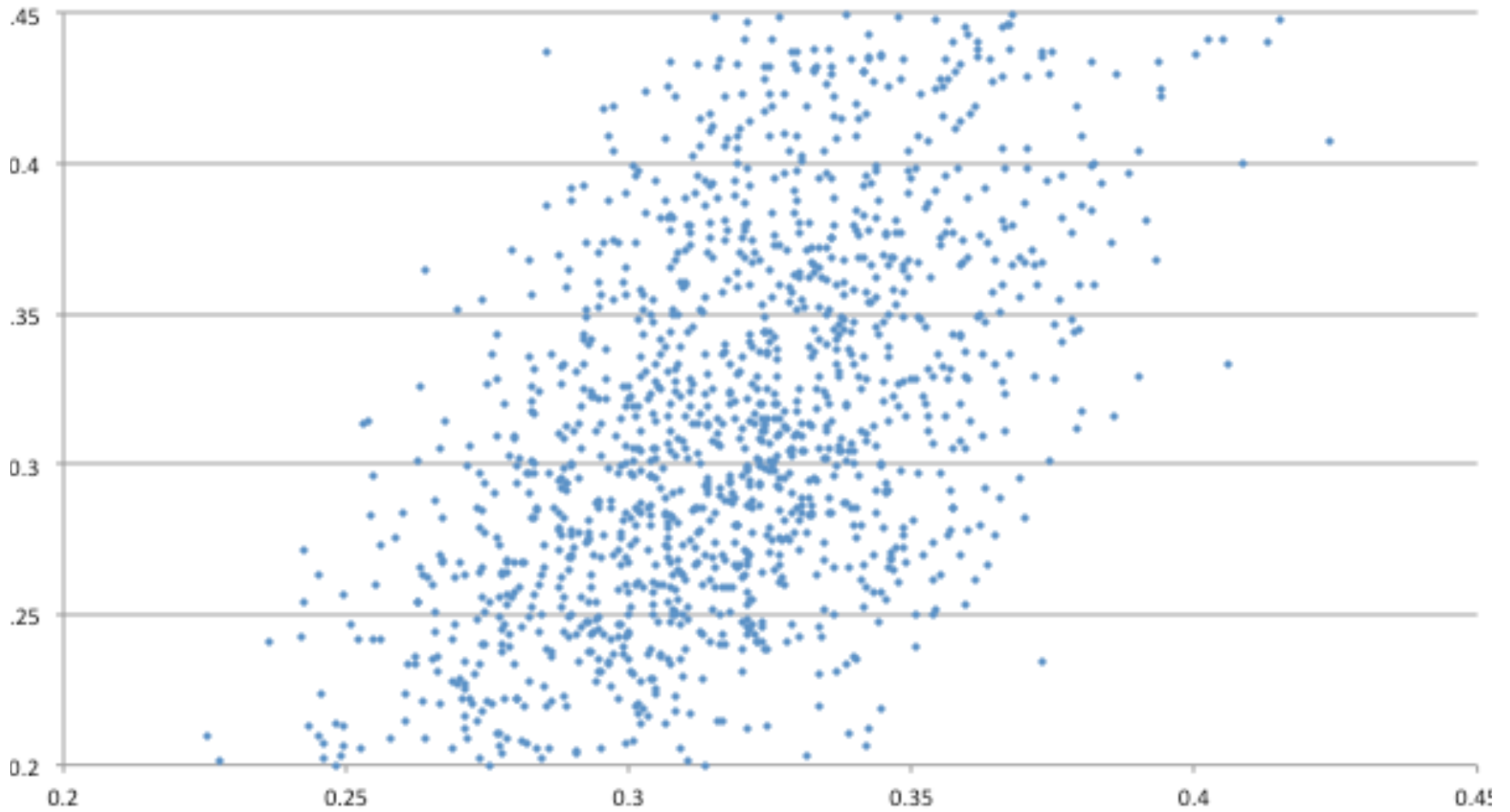
Results

Most advances to third base

Fewest advances to third base

	ID	Pbatter	Pbatterrunner	Difference	Bats
1	ID	Pbatter	Pbatterrunner	Difference	Bats
2	hende103	0.57407407	0.342938006	0.231136069	L
3	maybj101	0.6	0.370265113	0.229734887	L
4	bouce101	0.57251908	0.345295673	0.227223411	L
5	eastl101	0.59459459	0.369592504	0.22500209	L
6	gentj101	0.58563536	0.372147722	0.213487637	L
7	dalrc101	0.54368932	0.342911791	0.200777529	L
8	nichb101	0.48484848	0.285851024	0.198997461	L
9	mincd101	0.54679803	0.353660291	0.193137739	L
10	herre102	0.51785714	0.327952441	0.189904702	L
11	kingj101	0.55063291	0.369427422	0.181205489	L
12	spenj101	0.51485149	0.337634824	0.177216661	L
13	mccow101	0.59649123	0.421231846	0.175259382	L
14	mathe101	0.52941176	0.357596347	0.171815418	L
15	baile101	0.51207729	0.340814268	0.171263026	L
16	trosh101	0.59047619	0.419724156	0.170752035	L
17	siebn101	0.53535354	0.365230334	0.170123201	L
18	coviw101	0.51020408	0.340223505	0.169980577	L
19	carbb101	0.4969697	0.328085794	0.168883903	L
20	yastc101	0.56549935	0.401330526	0.164168826	L

	ID	Pbatter	Pbatterrunner	Difference	Bats
1	ID	Pbatter	Pbatterrunner	Difference	Bats
2	zimmd101	0.1871345	0.359916609	-0.172782106	R
3	tavef101	0.13615023	0.300393313	-0.164243078	R
4	sandr002	0.1598513	0.30851178	-0.148660479	R
5	cotth001	0.15267176	0.301075741	-0.148403985	R
6	abbok002	0.12380952	0.270993951	-0.147184427	R
7	jackd002	0.15384615	0.296336475	-0.142490321	R
8	kosca101	0.23423423	0.373122723	-0.138888489	R
9	duncm001	0.20622568	0.341879552	-0.135653871	R
10	nixoo001	0.15352697	0.289042716	-0.135515745	B
11	pedrd001	0.19327731	0.327610573	-0.134333262	R
12	paquc001	0.18571429	0.319495189	-0.133780903	R
13	bevak001	0.21238938	0.342589305	-0.130199925	R
14	deerr001	0.18235294	0.311669447	-0.129316506	R
15	darwb101	0.2027027	0.331637239	-0.128934537	R
16	fuent101	0.21005917	0.338768317	-0.128709146	B
17	sodee101	0.18974359	0.318141229	-0.128397639	L
18	rizzp101	0.16307692	0.291085332	-0.128008409	R
19	ceder001	0.1734104	0.300667215	-0.12725681	B
20	thomg001	0.19900498	0.325463975	-0.126459	R

Results

- Correlation between $P_{batter} - P_{batterrunner}$ and leftyness is .6.

- Left-handed batters advance the runner to third base **9%** more often than righties

- Switch hitters are exactly average, **6%** below lefties and **3%** above righties (there are twice as many righties as lefties in MLB history)

- There is not a single righty in the top **90** or a single lefty in the bottom **30**

Effects

- Lefties are 6% more likely than average to advance the runner to third base, and an advance to third base instead of second base is worth .025 (1/40) wins, so for each plate appearance, where 5% of plate appearances are singles with a runner on first base, an average lefty is worth .025*.06*.05 = .000075 extra wins per plate appearance.

- In one season of baseball, a typical starting left-handed batter will have 600(PA)*.05 = 30 singles with runners on first, and 30*.06 = 1.8 singles with runners on first who make it to third who wouldn't have had the batter been right. Then they are undervalued on the season by .025*1.8 = .045 wins. Right-handed batters are overvalued by .025*.03*30 = .0225 wins.

- In modern baseball, 1 win is valued at $7 million, so .045 wins are valued at $300,000, and .0225 wins are valued at $150,000.

- Carl Yastrzemski (Red Sox, '61 – '83), with 771 of these plate appearances and a $P_{batter} - P_{batterrunner}$ of .164, may be undervalued by .025*.164*771 = 3.16 wins over his career, worth $21.5 million in 2014
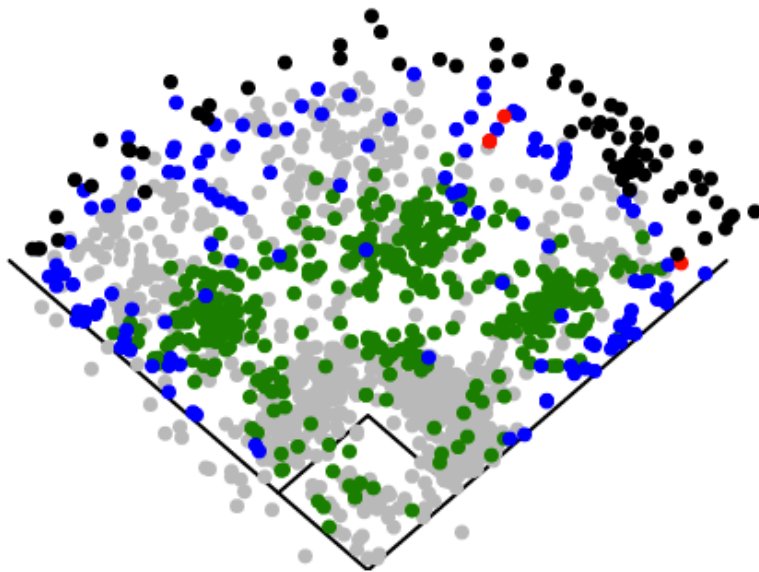
Other stuff

- Opposite-field lefty batters: Juan Pierre, Moises Alou, Ichiro Suzuki, Robinson Cano
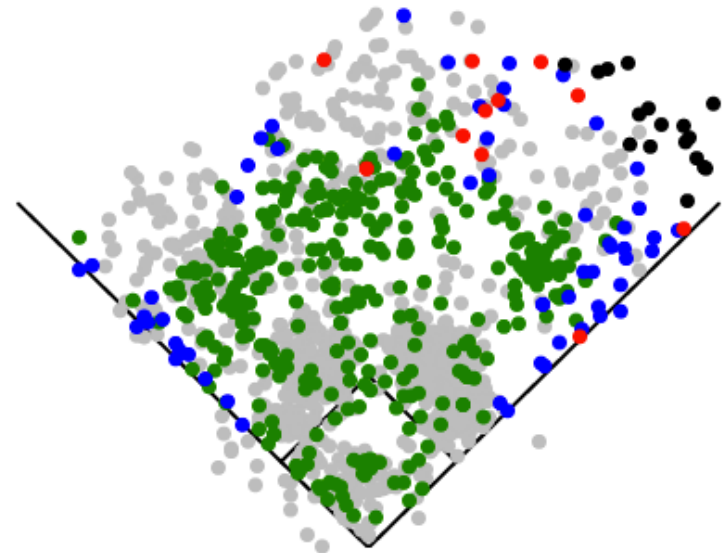

Robinson Cano: Hit Type
Seasons: 2012 to 2014

Out Single Double Triple Home Run

Ichiro Suzuki: Hit Type
Seasons: 2012 to 2014
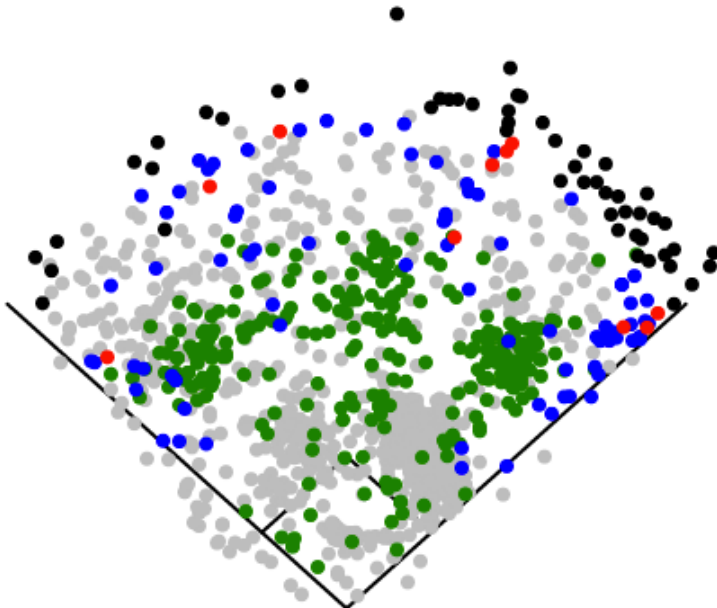
Out Single Double Triple Home Run
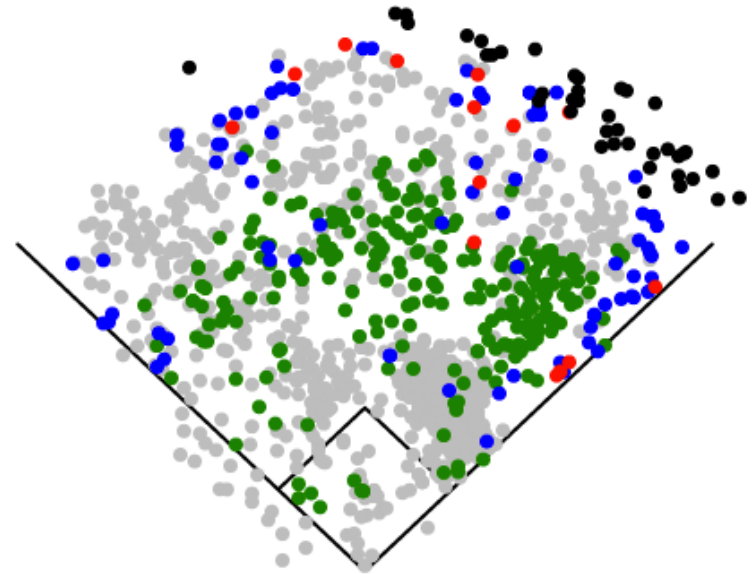
Other stuff

- Lefty pull hitters: Jason Heyward, Chase Utley, Jim Edmonds, Mo Vaughn

Jason Heyward: Hit Type
Seasons: 2012 to 2014

● Out   ● Single   ● Double   ● Triple   ● Home Run

Chase Utley: Hit Type
Seasons: 2012 to 2014

● Out   ● Single   ● Double   ● Triple   ● Home Run

Other stuff

- Correlation with leftyness: .6
- Correlation with batter's weight: .18
- Correlation between weight and leftyness: .06
- The weight hypothesis: Using weight as an approximation of speed, slower (heavier) batters may be more likely to advance a runner to third on a single because a hit to the same location might have gotten a faster batter to second base (thus making it a double)

Weight vs. P_{batter} - $P_{batterrunner}$
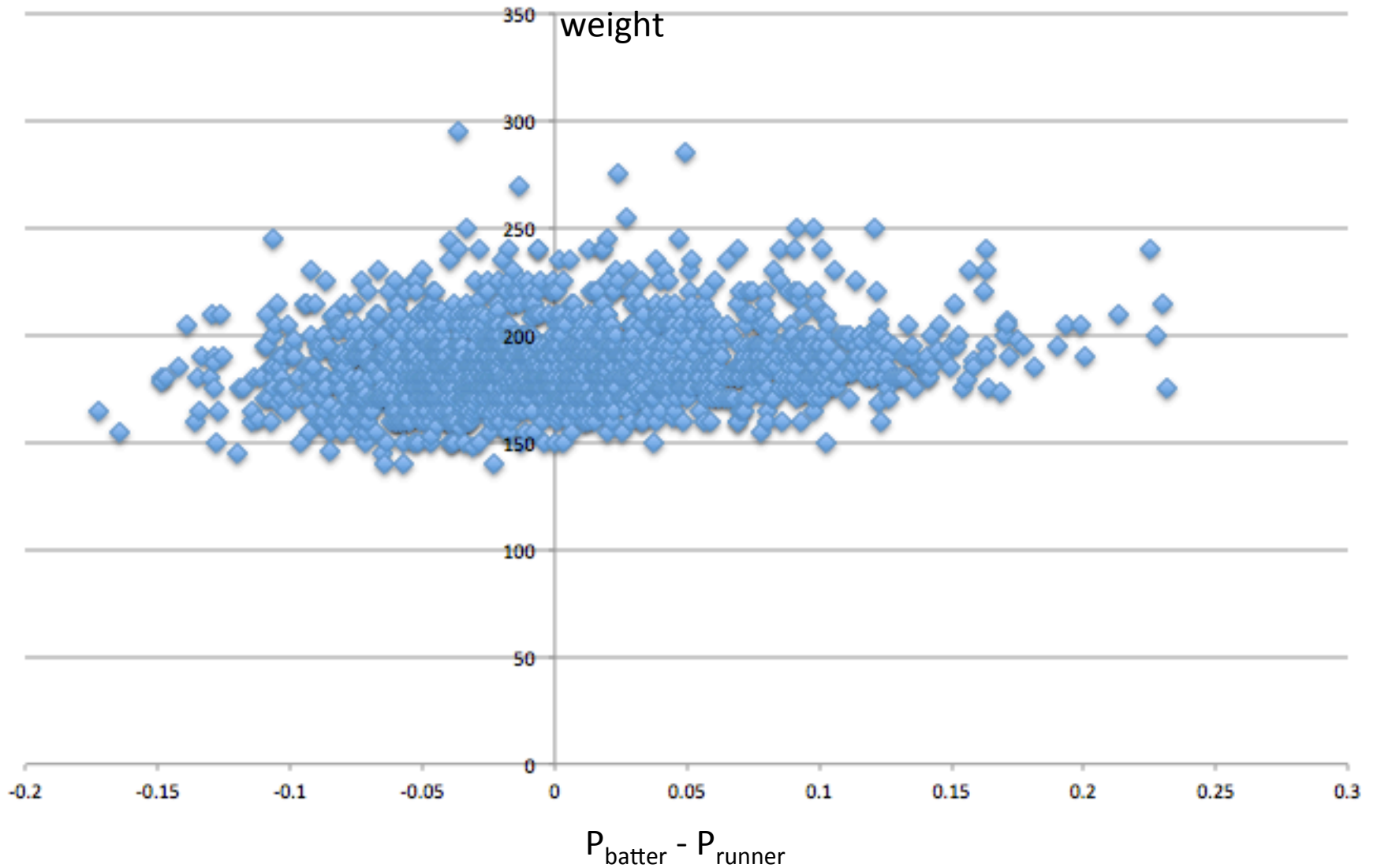
Potential areas for improvement

- Right now the averages are over a player's career. Speed starts to fade mid-career

- P_{runner} may be affected by the runner's batters. We may need $P_{runnerbatter}$ or a PageRank-like algorithm to get "true" P_{batter} and P_{runner}

- There are varying degrees of "pull hitters" beyond L/R. Accounting for this will yield more significant results for the very pully hitters and more accurately represent small differences for spray hitters

- Pull matters, but so does hang time

Potential areas for improvement

- What about singles with runners on second, or doubles with runners on first? Maybe more linked to power than handedness.

- Are lefties actually undervalued? We could check if WPA – WAR is correlated to being a lefty – quick check says yes! but I haven't checked salary.

- Are some pitchers more likely than others to allow the runner to advance?

Thanks!