Development and Utility

Prepared for the tru-media MLB hackathon

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For the purpose of this analysis, stuff is defined as:

The interaction between velocity, change in velocity, speed of breaking pitches, and break of pitches

The New York Times

The Mysteries of Pitching, and All That 'Stuff'

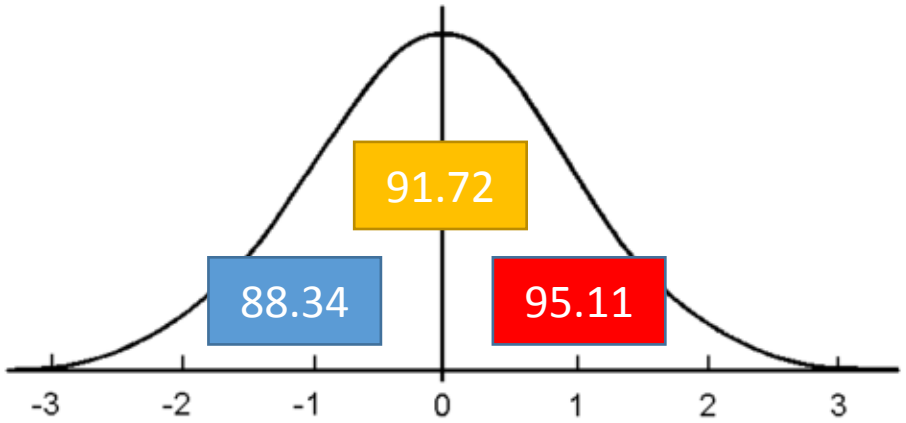
By JOHN BRANCH OCT. 3, 2015

The Nationals' Max Scherzer no-hit the Mets on Saturday. A former American League Cy Young Award winner, Scherzer said in discussing his season, "I feel like all my stuff's there." Kathy Kmonicek/Associated Press

Defining stuff

Z scores allow for presentation of standardized values, though they may not be in the same unit (ie, inches of break, mph, % change in speeds).

Ex) an average peak fastball velocity is 91.72 mph +/- 3.39. A fastball of 91.72 mph would have a z-score of 0, a 95.11 mph FB would have a z-score of 1, and an FB of 88.34 mph would have a z-score of -1.



Defining Stuff

Originally defined stuff in an article I wrote for FanGraphs[1]

Revisiting the "Stuff" Metric

by Mike Sonne - December 18, 2015

$$stuff = (FB_z \; x \; FB_{\%}) + Variation_{strategy} + (Move_z \; x \; BK_{\%})$$

$$Where:$$

$$FB_z = Z\ score\ of\ Max\ Velocity\ of\ all\ pitches$$
$$Variation_{strategy} = Max(\Delta spd\%_z, BKvel_z)$$
$$Move_z = z\ score\ of\ resultant\ x\ and\ z\ pitch\ movement$$
$$FB_{\%} = \%\ of\ times\ fastballs\ are\ thrown$$
$$BK_{\%} = \%\ of\ times\ breaking\ pitches\ are\ thrown$$

$$and:$$

$$\Delta spd\%_z = z\ score\ of\ \%\ change\ in\ pitch\ velocity$$
$$BKvel_z = z\ score\ of\ velocity\ of\ breaking\ pitch$$

[1] - http://www.fangraphs.com/community/revisiting-the-stuff-metric/

Defining Stuff - Example

David Price August 21, 2015 vs. LAA

FBvel 95.71 mph

Curve 78.33 mph

- 18.15% difference in velocity

Break Distance

- Distance between highest rising fastball and furthest dropping breaking pitch

FB usage 61.47%

Breaking/Offspeed usage 38.53%

FBz = 0.81

VarStrat (change in speed) = 0.58

BreakDistancez = 0.42

Stuff = 1.81

DATE	IP	H	R	ER	HR	BB	SO	GB	FB	Pit
Aug 21	8.0	6	2	2	1	1	9	9	12	109

Testing Stuff

For the Tru-Media hackathon, I re-calculated stuff for each pitcher, from both the provided database, and the PitchFx database

http://www.baseballheatmaps.com/pitch-fx-download/

Previously, stuff was calculated from yearly averages for each starting pitcher

For this analysis, I calculated stuff on a game by game basis

Game by Game calculation

- A pitch had to be thrown 5 times in a game for it to be included in the analysis
- Eephus pitches and screw-balls were not included
- Stuff was calculated for each pitcher, for every game they appeared in
- Average stuff was then calculated over the course of the season

Stuff Averages

The range of calculated stuff went from -3.38 (R.A. Dickey) to 4.16 (Jake Arrieta).

50th percentile stuff was 0.44

- Example: Matt Shoemaker, Brandon Morrow

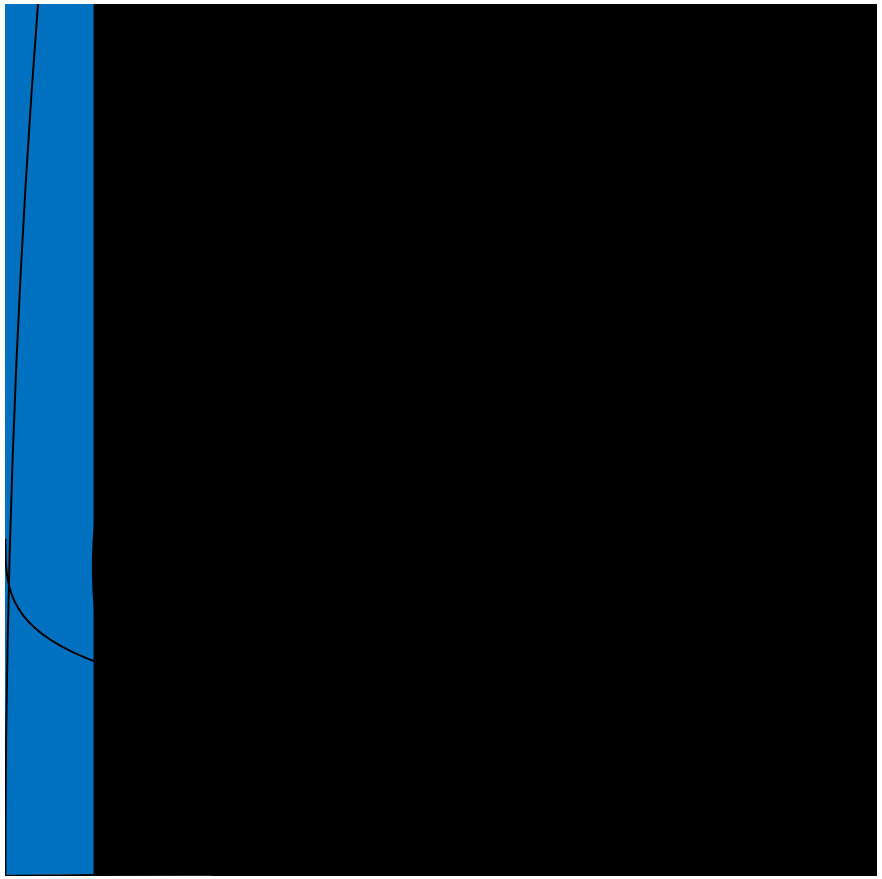
To be included in further calculations

- Stuff was calculated for all games where a pitcher threw a minimum of 75 pitches

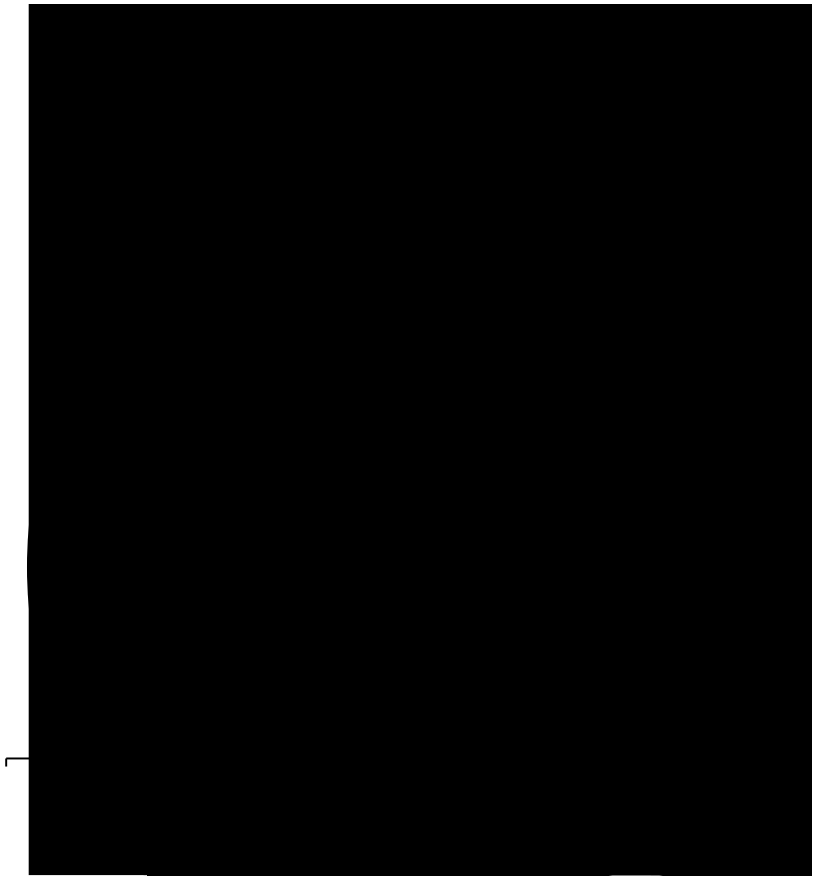
Percentile	Stuff
100%	4.16
95%	1.74
90%	1.42
85%	1.25
80%	1.11
75%	1.00
70%	0.88
65%	0.73
60%	0.64
55%	0.55
50%	0.44
45%	0.34
40%	0.21
35%	0.06
30%	-0.08
25%	-0.22
20%	-0.34
15%	-0.51
10%	-0.79
5%	-1.46
0%	-3.38

Stuff results

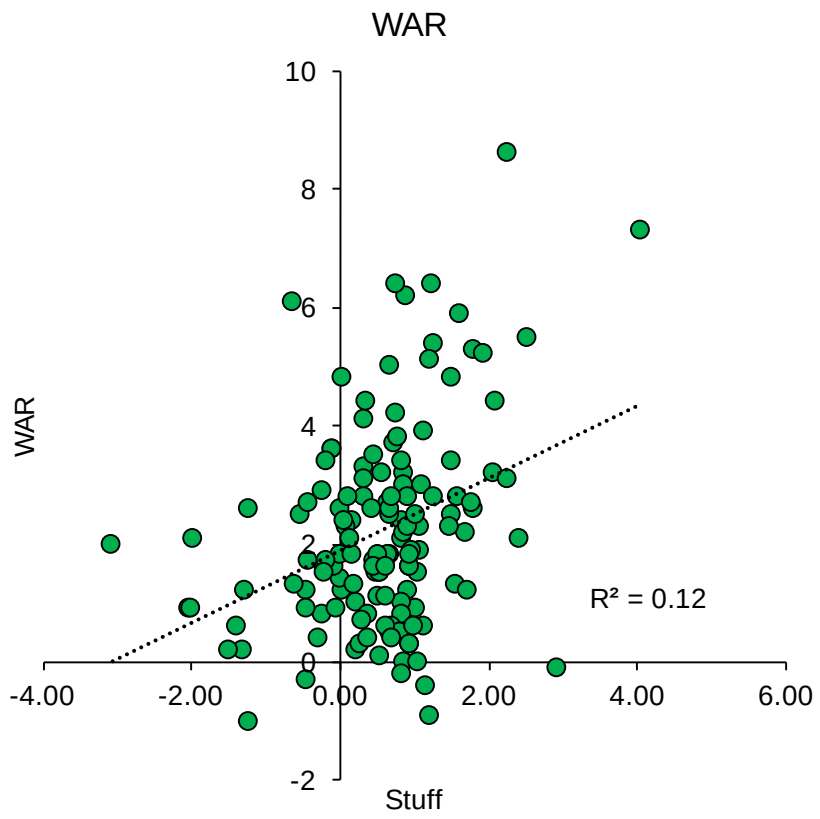
Stuff with xFIP: r = -0.38



Stuff with k/9: r = 0.40



Stuff Results

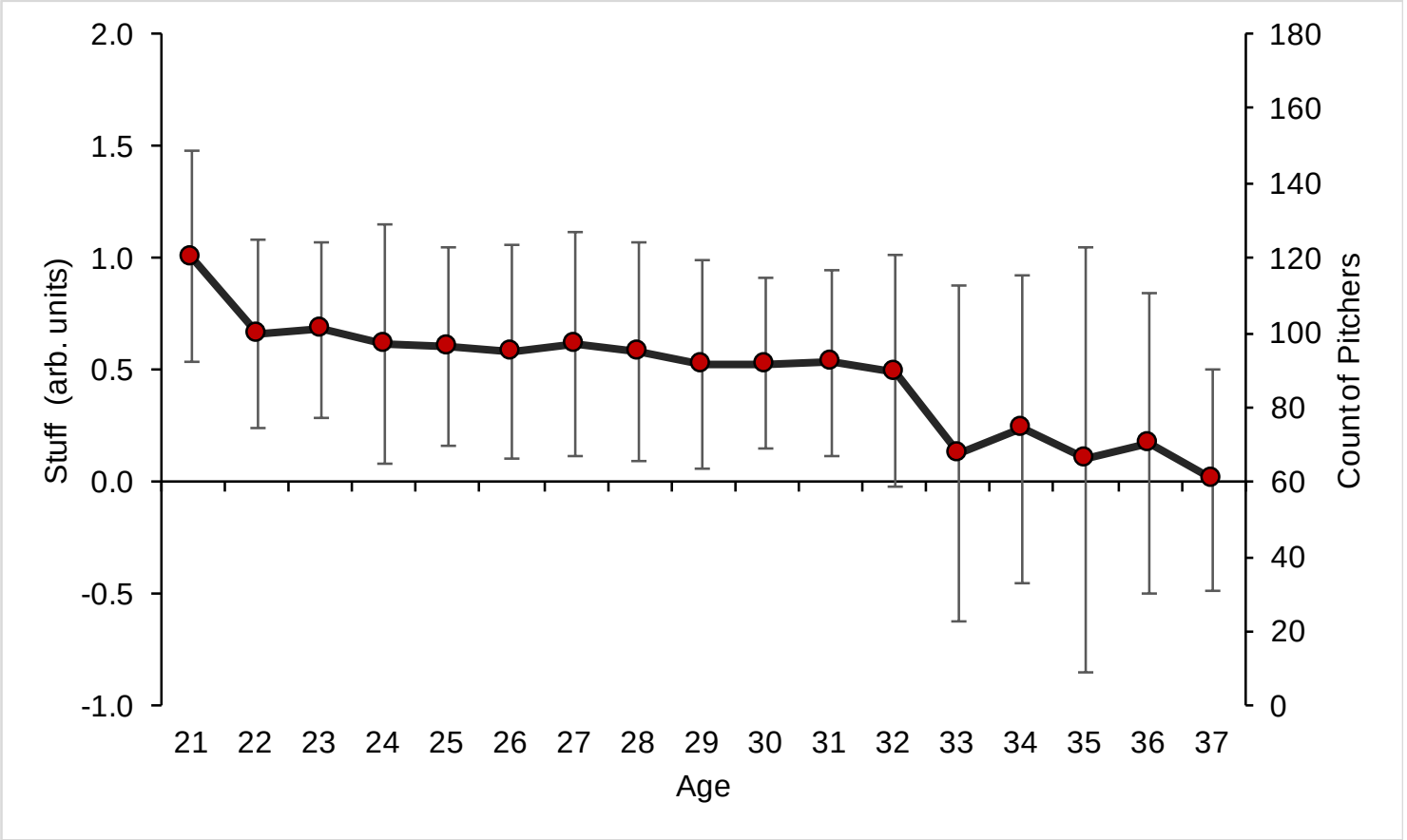


Rank	Name	Stuff	Peak Velocity	Low Velocity	Change in Vel (%)	Break (")	Breaking Vel (mph)
1	Jake Arrieta	4.04	94.44	80.59	0.15	25.28	90.10
2	Kyle Lohse	2.91	89.75	75.63	0.16	26.60	84.21
3	Corey Kluber	2.53	92.83	82.72	0.11	19.52	88.64
4	Jimmy Nelson	2.41	93.35	82.86	0.11	23.51	86.61
5	Noah Syndergaard	2.26	97.10	81.52	0.16	20.85	82.76
6	Clayton Kershaw	2.24	93.61	73.56	0.21	25.06	88.08
7	Matt Harvey	2.09	95.78	83.80	0.13	19.37	89.15
8	Nathan Eovaldi	2.06	96.60	75.79	0.22	17.15	84.30
9	Jacob deGrom	1.93	95.12	82.28	0.13	19.08	89.16
10	Christopher Archer	1.81	95.18	86.30	0.09	18.75	87.80
11	Edinson Volquez	1.80	94.03	80.65	0.14	23.11	80.65
12	Yordano Ventura	1.76	96.61	84.11	0.13	22.24	84.11
13	Joe Kelly	1.72	95.62	80.20	0.16	21.75	84.90
14	Zack Greinke	1.61	92.00	74.06	0.20	23.72	86.96
15	Justin Verlander	1.59	93.15	79.43	0.15	23.96	85.76
16	Chris Heston	1.56	89.51	75.03	0.17	18.74	75.47
17	Carlos Martinez	1.51	95.79	85.06	0.11	19.50	85.09
18	Garrett Richards	1.51	95.68	82.87	0.13	15.20	87.24
19	Carlos Carrasco	1.49	94.78	84.28	0.11	17.00	87.76
20	Michael Wacha	1.47	94.17	76.15	0.19	23.71	75.79
21	Felix Hernandez	1.27	92.25	80.07	0.13	20.50	82.95
22	Gerrit Cole	1.25	95.57	82.31	0.14	12.41	87.12
23	Max Scherzer	1.23	94.06	80.45	0.14	19.39	86.11
24	Madison Bumgarner	1.22	92.16	76.30	0.17	20.17	86.31
25	Jeremy Guthrie	1.21	91.76	77.35	0.16	21.62	81.60

Further Utility Stuff and Age

Calculated from FanGraphs yearly data

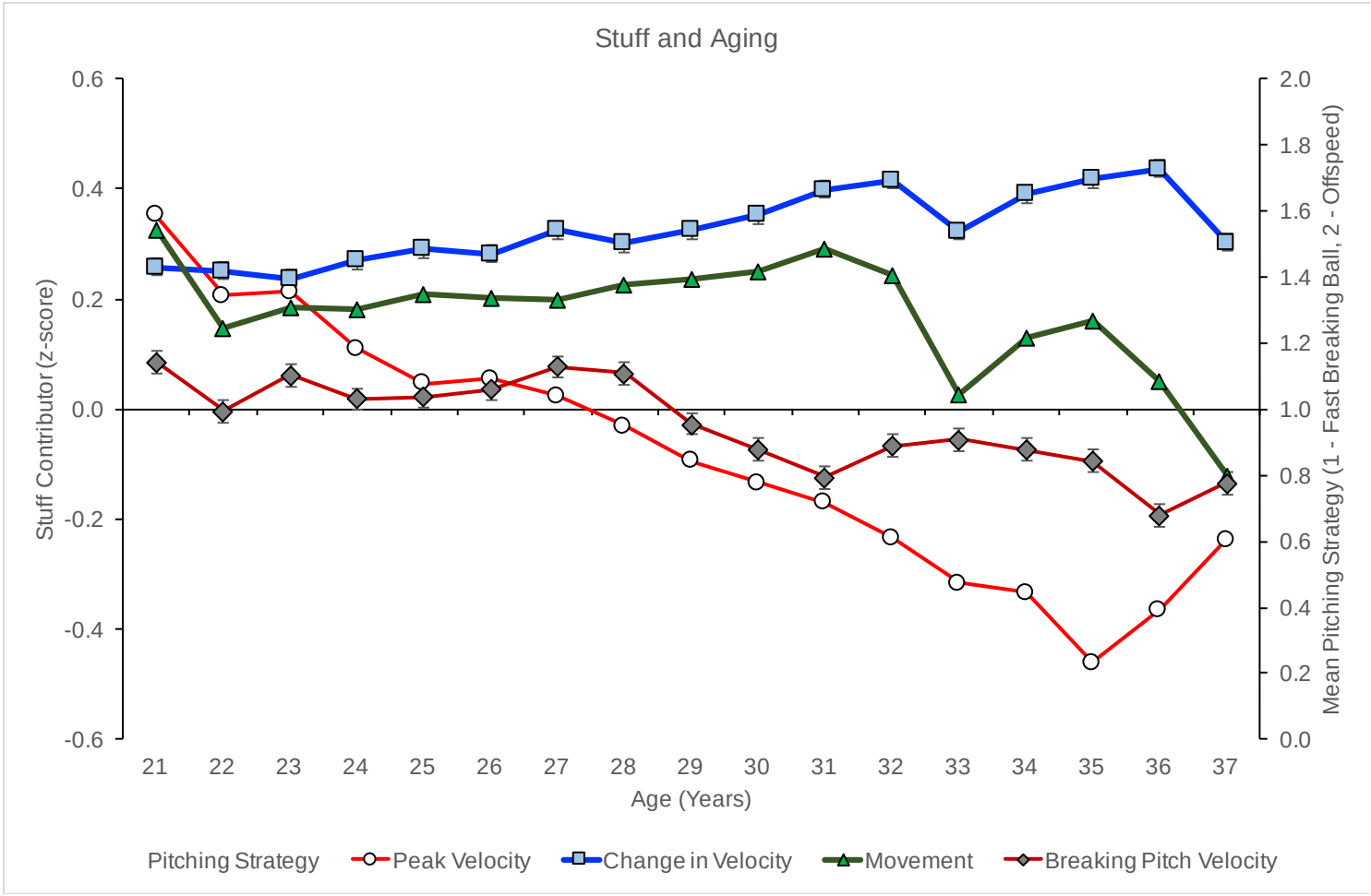
Stuff gradually diminishes with age, with a sharp drop-off after age 32



Stuff and Age

Velocity declines with age as expected (for both fastball and breaking ball velocity)

% change in velocity actually increases with age, as does movement. However, after 32 these effects drop off sharply.

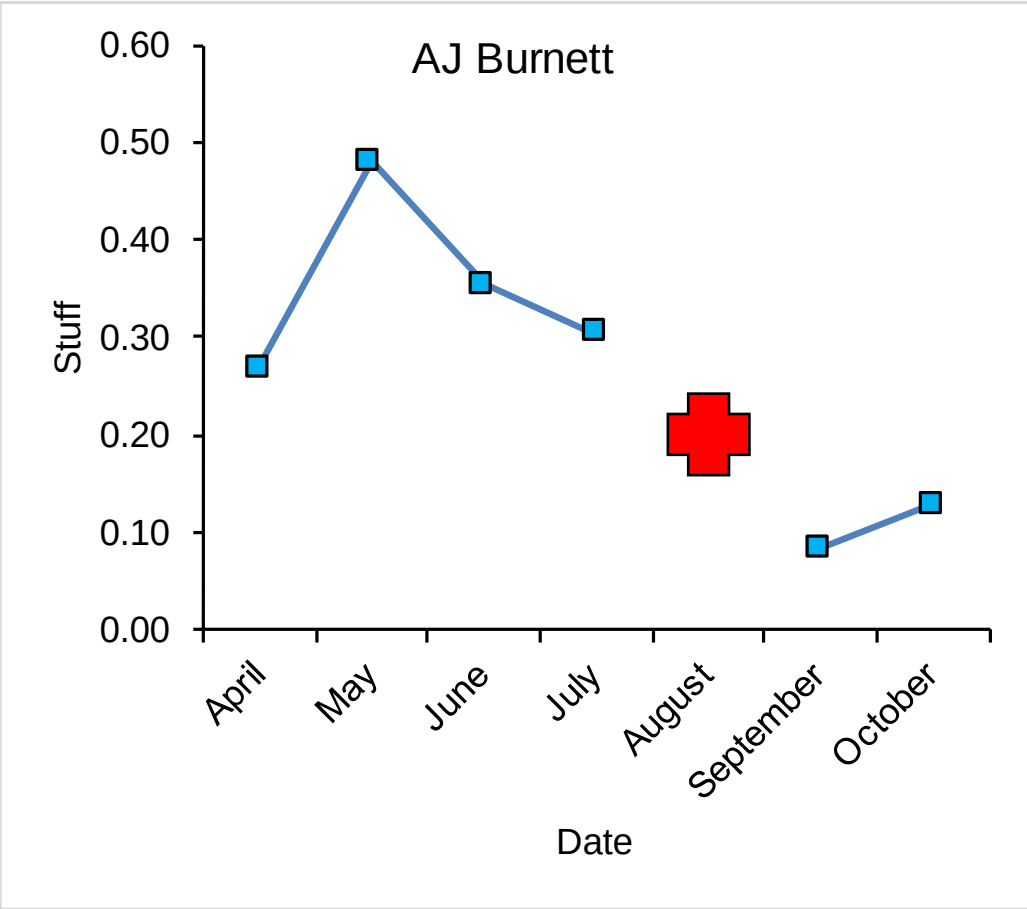


Stuff and Injury Case Studies

Injury to the arm can lead to diminished velocity, control, and movement on pitches

Case studies will be presented to examine the lead up to injury, as well as recovery from injury

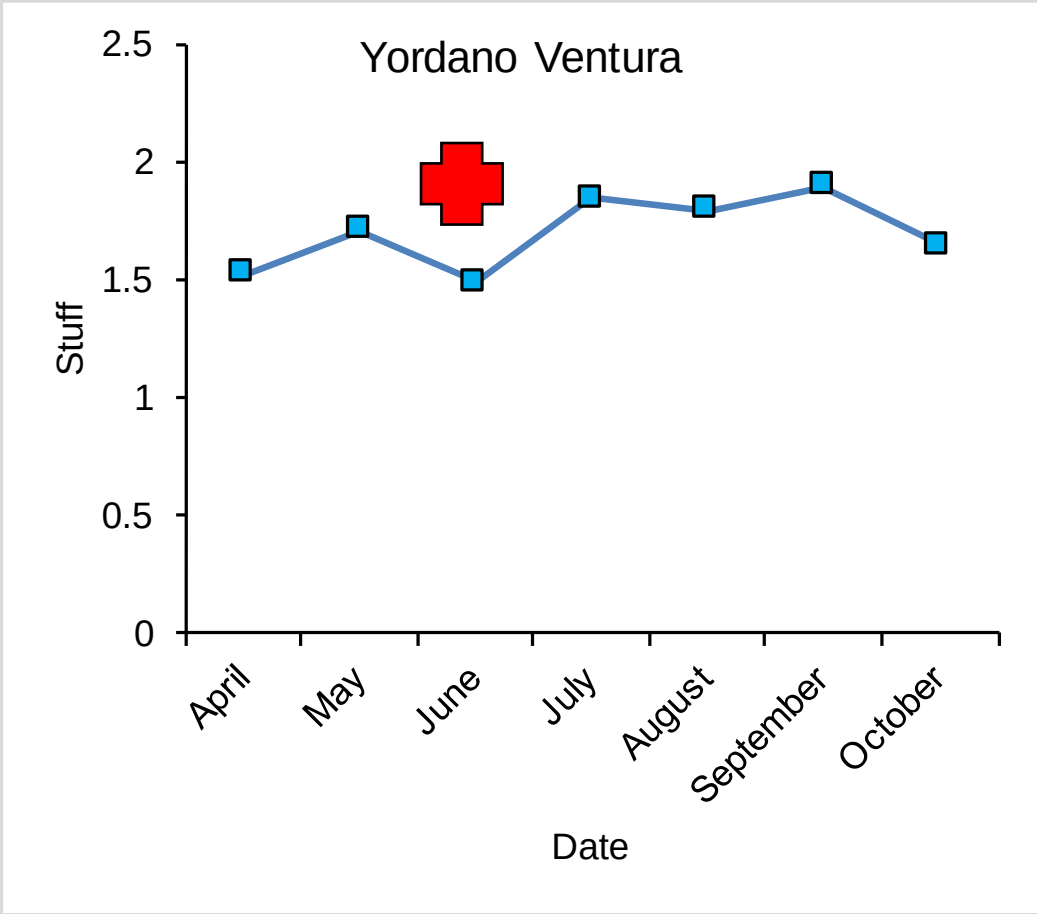
Stuff and Injury AJ Burnett



AJ Burnett had a flexor strain injury at the end of July. After sitting out the month of August, he returned in September and October.

those months, with his stuff dropping by nearly 70% between July and September

Stuff and Injury Yordano Ventura

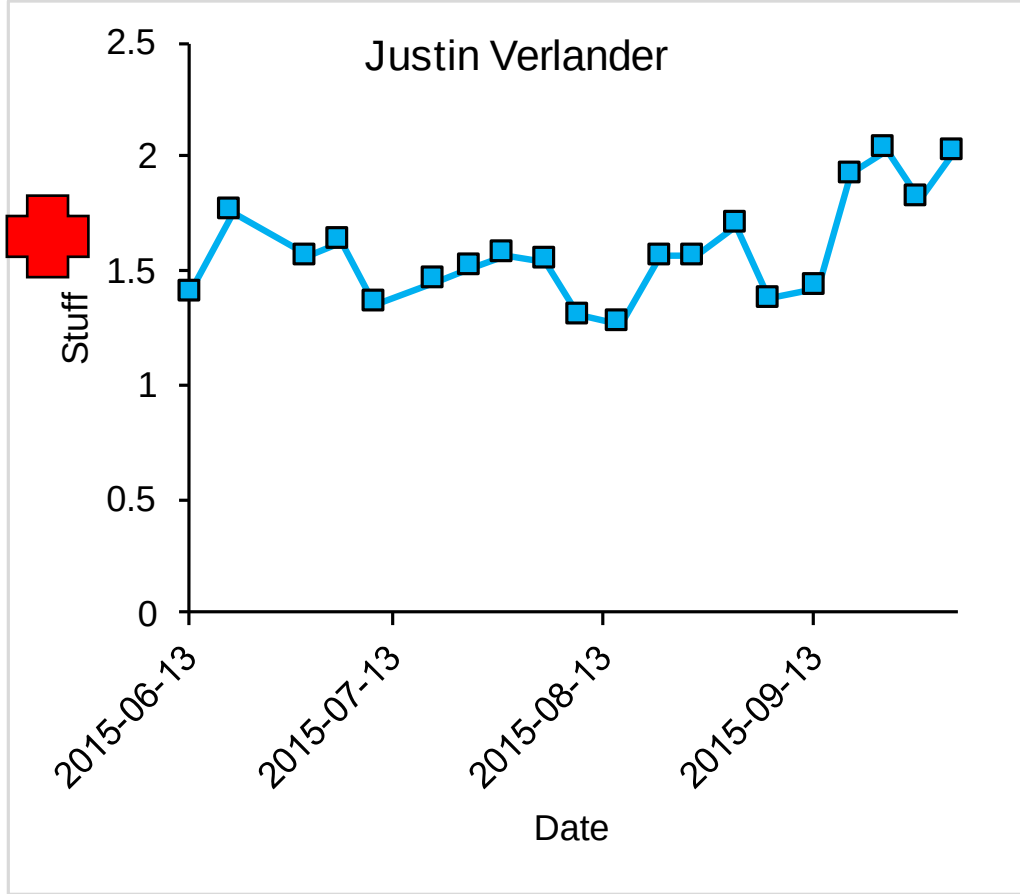


Ventura had an elbow in jury in June, resulting in the lowest stuff he recorded all year. After returning to the line up, his stuff

level.

This return to form allowed Ventura to continue to pitch at his normal ability throughout the rest of the season.

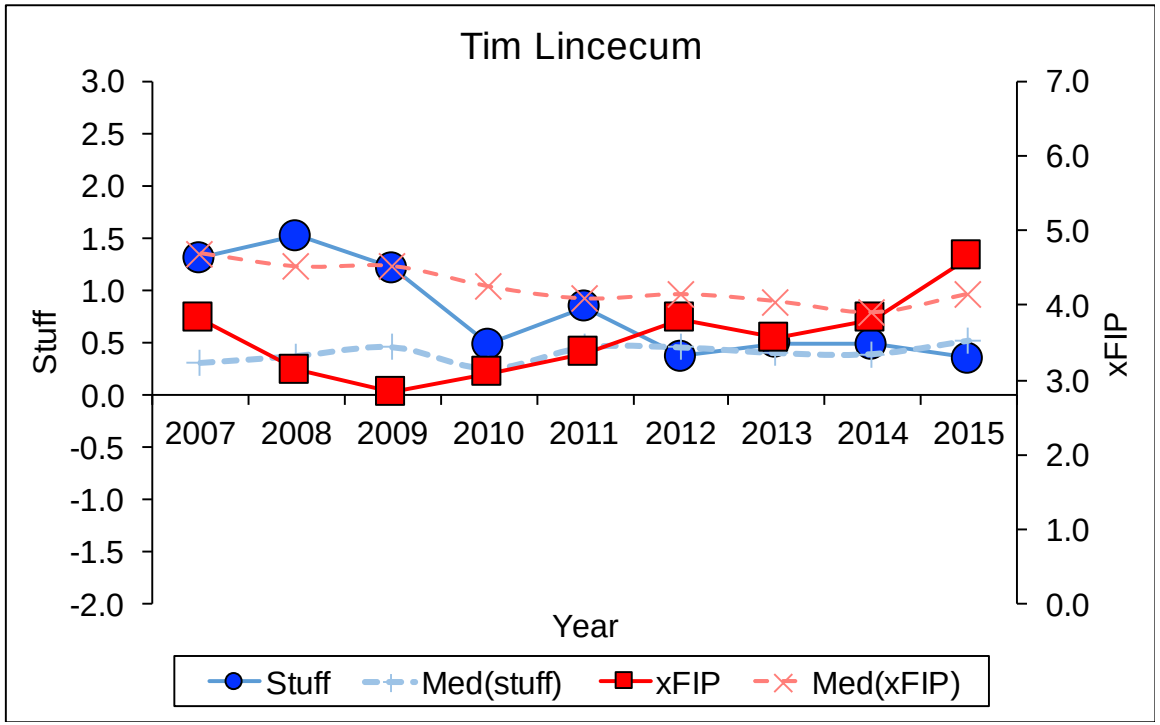
Stuff and Injury Justin Verlander



Verlander returned in June from a Triceps injury, before eventually having one of his better seasons in recent years

At the start of the year, his stuff was below his average however, by the end of the season, his stuff was over 2.0 nearly 25% higher than his June starts

Stuff and Injury Tim Lincecum



Lincecum had exceptionally high

stuff fell off in 2012 around the time when hip injuries took their toll on him.

In recent years, his stuff has been around league average, or worse, and his xFIP has risen in a similar fashion.

Stuff A summary

Stuff is a measure of the interaction between velocity, change in velocity, break distance and speed of breaking pitches

It has a significant relationship with K/9, WAR, and xFIP

returns from injury, or determining how a player may age

It also has potential in identifying break-out players who my be on the verge of stardom if control/durability issues are fixed

See how stuff has changed

Select from the dropdown to see how stuff has changed in players since 2007

https://docs.google.com/spreadsheets/d/1PU3u3sJpr_jv70VAJIlyXnvOh4pq56l7eXuo70Py81Y/edit#gid=2140502771

(Calculated from yearly averages from FanGraphs data)

Additional Information

For more reading on stuff, and other information, visit:

www.mikesonne.ca

Thanks for your interest!

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MySQL Queries - from PitchFX

```
select  pitcher,
        pitchType,
        seasonYear,
        month(gameDate),
        inning,
        count(spinRate) as pitches,
        round(avg(releaseVelocity),2) as velocity,
        round(std(releaseVelocity),2) as vel_std,
        round(avg(spinRate),2) as spin,
        round(std(spinRate),2) as spin_std,
        round(avg(spinDir),2) as spin_dir,
        round(std(spinDir),2) as spin_dir_std,
        round(avg(x0),2) as x_release,
        round(std(x0),2) as x_release_std,
        round(avg(z0),2) as z_release,
        round(std(z0),2) as z_release_std,
        count(DISTINCT batter) as BattersFaced,
        SUM(CASE
             WHEN paResult="S" or paResult="D" or paResult="T" or paResult="HR" or paResult="BB" THEN 1
             ELSE 0
           END) AS whip,
        SUM(CASE
             WHEN paResult="K" THEN 1
             ELSE 0
           END) AS k,
        SUM(CASE
             WHEN paResult="K" or paResult='IP_OUT' THEN 1
             ELSE 0
           END) AS outs
from hackathon where seasonYear = 2015 and gameType = "REG" group by pitcherID, pitchType
```