MLB Umpires – The Study of Imperfection

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Goals of the Project

- Analyze the variability of precision and accuracy during decision making
  - Utilize MLB Umpires as a case study
- Look for trends and factors that may cause variability
- View the magnitude of the effects at a pitch by pitch and season levels

Data

- Scrape pitch by pitch data from the MLB API from 2021 - 2023
  - Used PITCHF/x data to plot incorrect calls and gather individual pitcher data
- Utilize Umpire Scorecards for umpire summary statistics since 2015
- Used MLB.com for Umpire Information
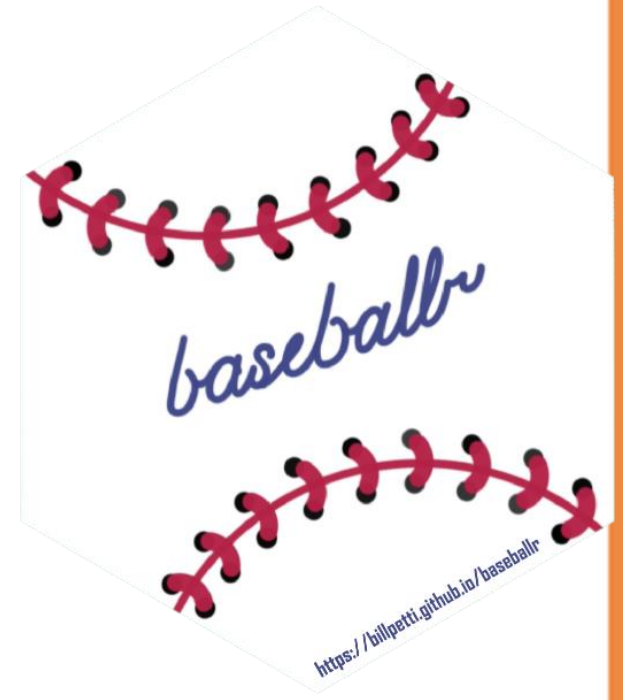
Tangotiger Expected Run Matrix

L: 0-2	K: 1-2	J: 0-1	I: 2-2	H: 1-1	G: 0-0	F: 1-0	E: 2-1	D: 3-2	C: 2-0	B: 3-1	A: 3-0	Baserunners
												(0 outs)
0.42	0.44	0.47	0.48	0.50	0.51	0.55	0.55	0.59	0.61	0.67	0.74	-- -- --
0.76	0.80	0.84	0.87	0.89	0.90	0.96	0.98	1.03	1.07	1.15	1.25	1B -- --
0.99	1.03	1.10	1.09	1.13	1.15	1.20	1.20	1.18	1.25	1.30	1.38	-- 2B --
1.31	1.34	1.41	1.41	1.47	1.50	1.58	1.57	1.64	1.74	1.83	1.98	1B 2B --
1.23	1.26	1.33	1.34	1.37	1.38	1.44	1.41	1.43	1.48	1.52	1.60	-- -- 3B
1.56	1.60	1.68	1.67	1.74	1.78	1.85	1.82	1.86	1.91	1.98	2.08	1B -- 3B
1.77	1.81	1.91	1.85	1.95	1.98	2.03	1.99	1.97	2.09	2.11	2.19	-- 2B 3B
2.08	2.09	2.21	2.26	2.27	2.32	2.40	2.46	2.59	2.52	2.63	2.89	1B 2B 3B
												(1 outs)
0.21	0.22	0.24	0.25	0.26	0.27	0.30	0.30	0.32	0.35	0.38	0.43	-- -- --
0.41	0.43	0.48	0.49	0.51	0.53	0.57	0.57	0.60	0.64	0.69	0.77	1B -- --
0.55	0.58	0.63	0.63	0.67	0.69	0.73	0.72	0.71	0.79	0.79	0.85	-- 2B --
0.76	0.80	0.86	0.86	0.91	0.93	1.00	1.00	1.06	1.10	1.21	1.33	1B 2B --
0.77	0.80	0.90	0.86	0.93	0.97	1.00	0.99	0.95	1.05	1.06	1.13	-- -- 3B
0.98	1.03	1.13	1.09	1.18	1.21	1.24	1.25	1.24	1.33	1.36	1.44	1B -- 3B
1.10	1.17	1.28	1.22	1.32	1.37	1.42	1.39	1.33	1.48	1.48	1.54	-- 2B 3B
1.27	1.34	1.43	1.46	1.53	1.57	1.68	1.68	1.78	1.82	1.91	2.15	1B 2B 3B
												(2 outs)
0.06	0.07	0.09	0.09	0.10	0.10	0.12	0.12	0.12	0.14	0.16	0.18	-- -- --
0.14	0.16	0.19	0.18	0.21	0.23	0.26	0.24	0.25	0.30	0.32	0.37	1B -- --
0.19	0.22	0.27	0.26	0.31	0.32	0.35	0.34	0.32	0.38	0.39	0.41	-- 2B --
0.26	0.31	0.38	0.38	0.41	0.44	0.49	0.49	0.49	0.57	0.61	0.68	1B 2B --
0.23	0.26	0.32	0.31	0.34	0.36	0.39	0.38	0.37	0.43	0.45	0.49	-- -- 3B
0.31	0.37	0.42	0.44	0.47	0.50	0.55	0.54	0.54	0.63	0.67	0.73	1B -- 3B
0.35	0.39	0.48	0.44	0.53	0.57	0.62	0.57	0.54	0.68	0.69	0.75	-- 2B 3B
0.46	0.54	0.62	0.67	0.74	0.76	0.90	0.89	0.92	1.05	1.18	1.38	1B 2B 3B

Defining Variables

- Incorrect Strike: Called Strike beyond 1 ball length of the strike zone

- Incorrect Ball: Called Strike within 1 ball length of the strike zone

- Impact: The absolute difference between the run expectancy value of the correct count and the called count
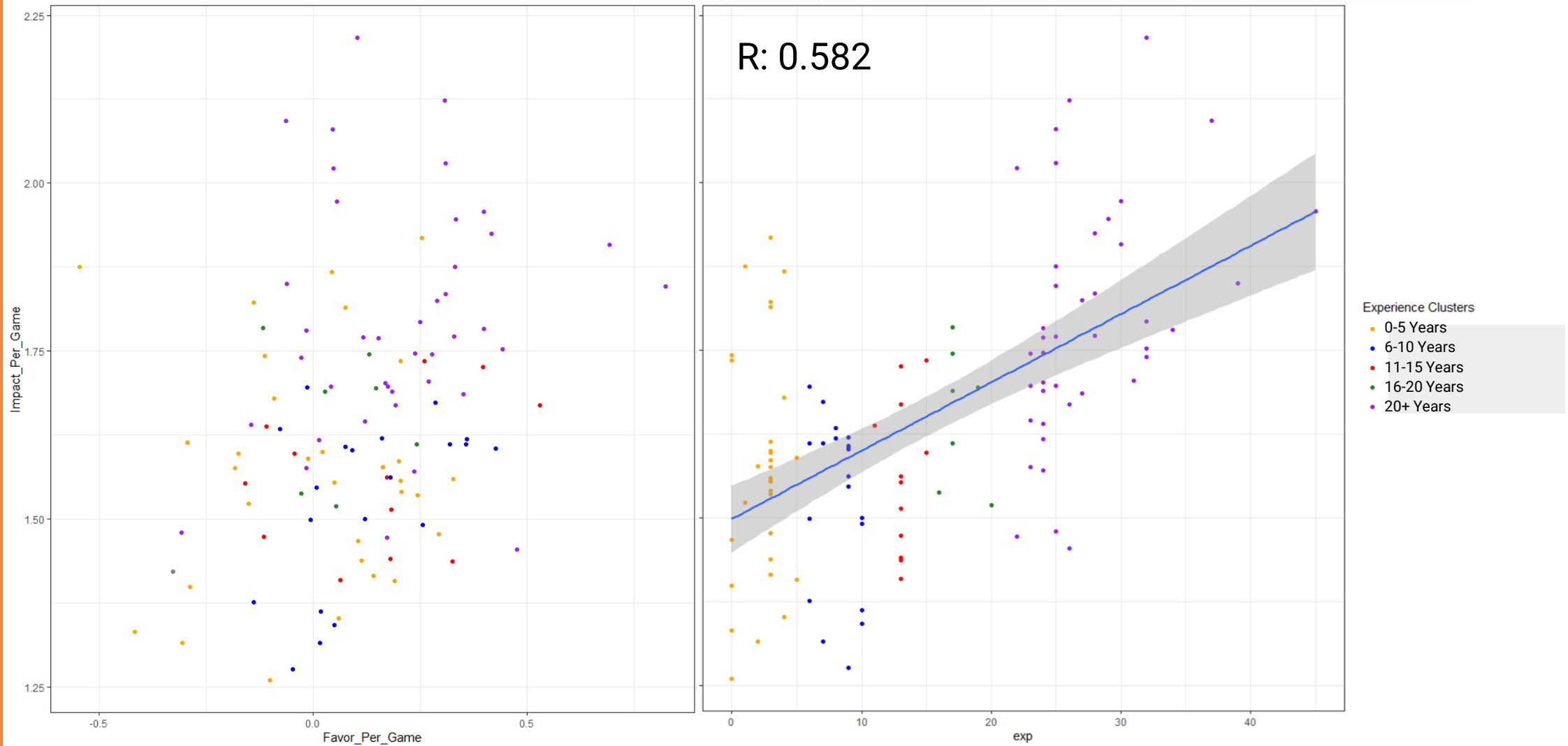
- Favor: Non absolute Impact

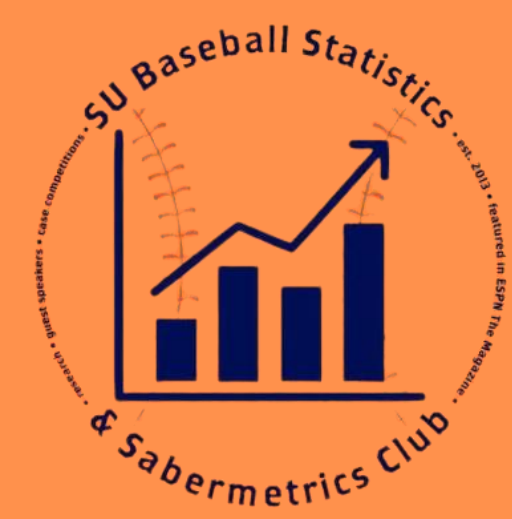Note: Over a Run and a Half of Run Impact per Game!

Since 2021…	
Incorrect Calls	83,129
Incorrect Call PCT	4.12%
Total Favor	976.19
Favor Per Game	0.012
Impact	11233.97
Impact Per Game	1.629

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Umpire Analysis

Umpires at the Game and Season Level

Umpire Overturns

Year	Overturns
2015	57
2016	49
2017	48
2018	31
2019	35
2020	20
2021	22
2022	22

- What is it: When the favor of a team is greater than its winning or losing run differential.

- 284 occurrences ~2% of games from 2015-2022

- 171 vs 113 for the Home and Away teams

- Significant decrease in overturns per year.

Season Wide Impact

Team	Wins Gained	Wins Lost	Team PlusMinus
ARI	11	10	+1
ATL	5	13	-8
BAL	8	5	+3
BOS	9	20	-11
CHC	12	11	+1
CIN	20	5	+15
CLE	4	12	-8
COL	7	6	+1
CWS	8	8	0
DET	8	3	+5
HOU	14	9	+5
KC	10	4	+6
LAA	6	11	-5
LAD	4	10	-6
MIA	9	10	-1
MIL	8	10	-2
MIN	7	10	-3
NYM	9	11	-2
NYY	16	10	+6
OAK	12	7	+5
PHI	9	2	+7
PIT	8	4	+4
SD	9	12	-3
SEA	9	18	-9
SF	12	10	+2
STL	11	11	0
TB	6	9	-3
TEX	8	8	0
TOR	10	11	-1
WSH	15	14	+1

- Separated Overturns into wins gained and lost per team

- Calculated percentage of overturned outcome using pythagorean expected win percentage taking into account favor

Case Study 1

2019 NL Playoff Standings

Seed		Team	Record	Wild Card
1	LA	Los Angeles Dodgers	106-56	--
2	A	Atlanta Braves	97-65	--
3	StL	St. Louis Cardinals	91-71	--
4	W	Washington Nationals	93-69	+4
5	Brewers	Milwaukee Brewers	89-73	0
E	Mets	New York Mets	86-76	-3
E	A	Arizona Diamondbacks	85-77	-4

2019 NL Adjusted Playoff Standings

Seed		Team	Record	Wild Card
1	LA	Los Angeles Dodgers	106-56	--
2	W	Washington Nationals	95-67	--
3	A	Atlanta Braves	94-68	+6
4	StL	St. Louis Cardinals	91-71	--
5	Brewers	Milwaukee Brewers	88-74	0
E	A	Arizona Diamondbacks	86-76	-2
E	Mets	New York Mets	84-78	-4
Probability of Scenario:			**7.90%**	

Outcome	Probability
WSH BEAT ATL	32.47%
WSH TIE ATL	23.35%
ATL BEAT WSH	47.39%

Case Study 2

2018 NL Playoff Standings

Seed		Team	Record	Wild Card
T-1		Milwaukee Brewers	95-67	--
T-1	C	Chicago Cubs	95-67	+4
T-2	LA	Los Angeles Dodgers	91-71	--
T-2	CR	Colorado Rockies	91-71	0
3	A	Atlanta Braves	90-72	--
E	StL	St. Louis Cardinals	88-74	-3
E	P	Pittsburgh Pirates	82-79	-9

2018 NL Adjusted Playoff Standings

Seed		Team	Record	Wild Card
1		Milwaukee Brewers	95-67	--
2	A	Atlanta Braves	91-71	--
3	CR	Colorado Rockies	90-73	--
4	C	Chicago Cubs	94-68	+6
5	StL	St. Louis Cardinals	89-74	0
E	LA	Los Angeles Dodgers	88-74	0
E	P	Pittsburgh Pirates	81-80	-7

Outcome	Probability
CHC BEAT MIL	67.52%
CHC TIE MIL	16.36%
MIL BEAT CHC	10.44%
COL BEAT LAD	45.61%
COL TIE LAD	32.80%
LAD BEAT COL	21.58%

Outcome	Probability
STL ADV, LAD ELIM	14.25%
STL & LAD TIE	25.43%
STL & COL TIE	12.52%
STL ELIM	30.30%

Case Study 3

2016 NL Playoff Standings

Seed		Team	Record	Wild Card
1	C	Chicago Cubs	103-59	--
2	W	Washington Nationals	95-67	--
3	LA	Los Angeles Dodgers	91-71	--
T-4	NY	New York Mets	87-75	0
T-4	SF	San Francisco Giants	87-75	0
E	STL	St. Louis Cardinals	86-76	-1
E	M	Miami Marlins	79-82	-8

2016 NL Adjusted Playoff Standings

Seed		Team	Record	Wild Card
1	C	Chicago Cubs	101-61	--
2	W	Washington Nationals	95-67	--
3	LA	Los Angeles Dodgers	91-71	--
T-4	NY	New York Mets	86-76	0
T-4	STL	St. Louis Cardinals	86-76	0
T-4	SF	San Francisco Giants	86-76	0
E	M	Miami Marlins	80-81	-6
Probability of Scenario:			17.74%	

Outcome	Probability
NYM & SF ADV	20.54%
SF & STL ADV	12.53%
NYM & STL ADV	16.18%
3 WAY TIE	17.74%
STL & SF TIE, NYM ADV	6.76%
STL & NYM TIE, SF ADV	14.60%
SF & NYM TIE, STL ADV	10.31%
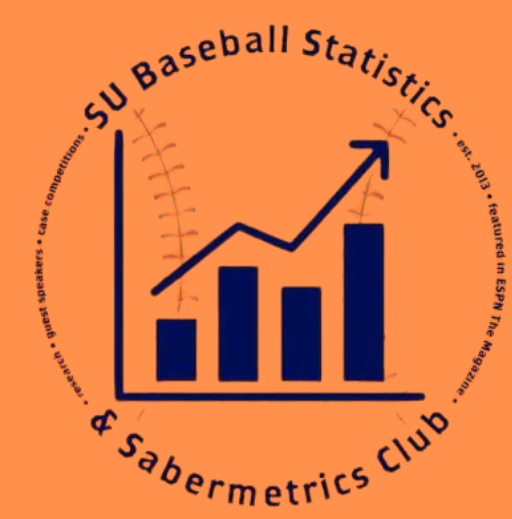
Umpires at the Pitch Level

Analyzing the Pitcher Umpire Impact

- Found probabilities for umpires to call Incorrect Balls/Strikes based on location and pitch type

- Looked at pitch arsenal, usage, and tendencies to find probabilities of pitch thrown locations

- Used previous Impact statistics to see what pitches were most affected positively or negatively

Strike Ball Discrepancies

WINNERS

Pitcher	Umpire	Pitch	Incorrect Strikes per 100	Incorrect Balls per 100	Delta
Yusmeiro Petit	Doug Eddings	Cutter	10.01	6.076	3.93
Josh Lindblom	Doug Eddings	Fastball	10.79	6.681	3.93
Zach Davies	Doug Eddings	Fastball	10.49	6.639	3.85
Kyle Freeland	Doug Eddings	Changeup	9.335	5.562	3.71
Matthew Liberator	Doug Eddings	Changeup	9.543	5.582	3.71

LOSERS

Pitcher	Umpire	Pitch	Incorrect Strikes per 100	Incorrect Balls per 100	Delta
Erasmo Ramirez	Alan Porter	Fastball	5.856	7.449	-1.59
Tyler Clippard	Alan Porter	Fastball	5.886	7.361	-1.47
Seth Martinez	Adrian Johnson	Sinker	7.575	9.032	-1.45
Rafael Montero	Adrian Johnson	Sinker	7.366	8.738	-1.37
Carmen Mlodzinski	Alan Porter	Fastball	5.817	7.147	-1.32

Impact and Favor

Pitcher	Umpire	Pitch	Total_Pitch_Run_Impact
Adam Oller	Ron Kulpa	Slurve	4.890
Marcus Stroman	Ron Kulpa	Slurve	4.844
Julio Urias	Ron Kulpa	Slurve	4.796
Jose Berrios	Ron Kulpa	Slurve	4.775
Adam Oller	Carlos Torres	Slurve	4.494

Pitcher	Umpire	Pitch	Total_Pitch_Favor
Yusmeiro Petit	Doug Eddings	Cutter	0.545
Josh Lindblom	Doug Eddings	Fastball	0.545
Zach Davies	Doug Eddings	Fastball	0.533
Kyle Freeland	Doug Eddings	Changeup	0.515
Matthew Liberator	Doug Eddings	Changeup	0.515

Pitcher	Umpire	Pitch	Total_Pitch_Run_Impact
Erasmo Ramirez	4-Seam Fastball	Alan Porter	-0.223
Tyler Clippard	4-Seam Fastball	Alan Porter	-0.207
Seth Martinez	Sinker	drian Johnsc	-0.198
Rafael Montero	Sinker	drian Johnsc	-0.187
Carmen Mlodzinski	4-Seam Fastball	Alan Porter	-0.186

Concluding Thoughts

- Umpire variability is legitimate, and correlates strongly with years of experience.

- Yearly Impacts can be substantial, change the course of the season

- Umpire's call pitches differently, can use that knowledge to predict performance.

Thank you!

Questions?

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