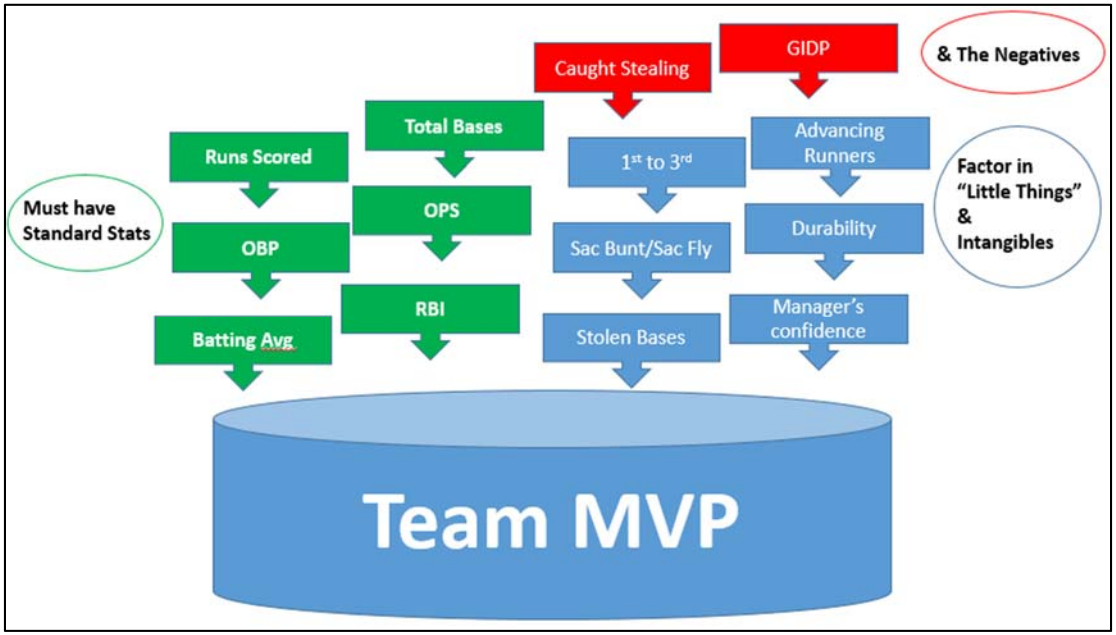
“Keeping 4Score: Discoveries and Results from Data Visualized 4Base Scorecards”

In June 2013 I asked myself what I thought was an easy question: Who is the Cardinals’ Team MVP?

It was midseason and the 2013 Cardinals were an offensive juggernaut racking up wins, and runs, and historic production with runners in scoring position. It was because the **team** was so good, and getting contributions from so many players, that my “easy” Team MVP question was not so easily answered.

The question led me to data mining from typical baseball sites. I spent days web browsing and tried hard to go beyond the standard stats for secondary components I felt were critical. In particular, I felt advancing runners was important but I could not find the exact information I wanted. Also, I was frustrated trying to obtain base running numbers. I envisioned the initial components I was looking for as something like this:



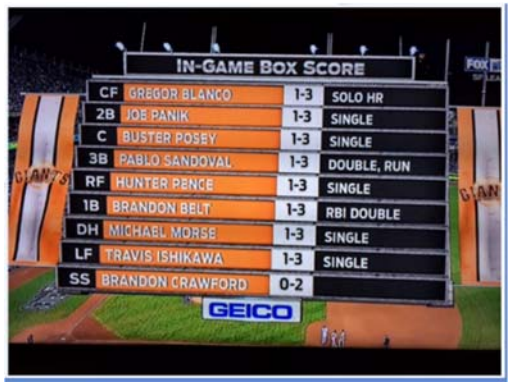
It occurred to me that in baseball much of the time it's not clear who the MVP of a single ***GAME*** is. If I addressed that question first perhaps that would lead to meaningful aggregate results as the season progressed.

So I reduced my original season MVP question down to: Who's the MVP for each **Game**:

Ok, so how to figure that out?

What I wanted to determine – for every game - was that game's clear Top Contributor. Perhaps I'd see whose game performance might be an under the radar example of the so-called "little things" teams need to win.

I was frustrated with "baseball speak" summaries like "1 for 3 with a Walk and 2 Sac Flies". I wanted a numerical value associated with that performance and I wanted to know how that player stacked up against a teammate who perhaps went "2 for 4". There's so much critical in-game information buried in these cryptic phrases, hidden in a typical box score, and sometimes not shown at all. What if the "2 for 4" player ground into a double play? What if he was caught stealing? What if the "1 for 3" player advanced 3 runners? How would these various plays measure up numerically? To illustrate how deficient the hits per AB view can be I enjoy showing this screenshot from the 2014 World Series Game 2 broadcast where **8 Players** are shown as "1 for 3".

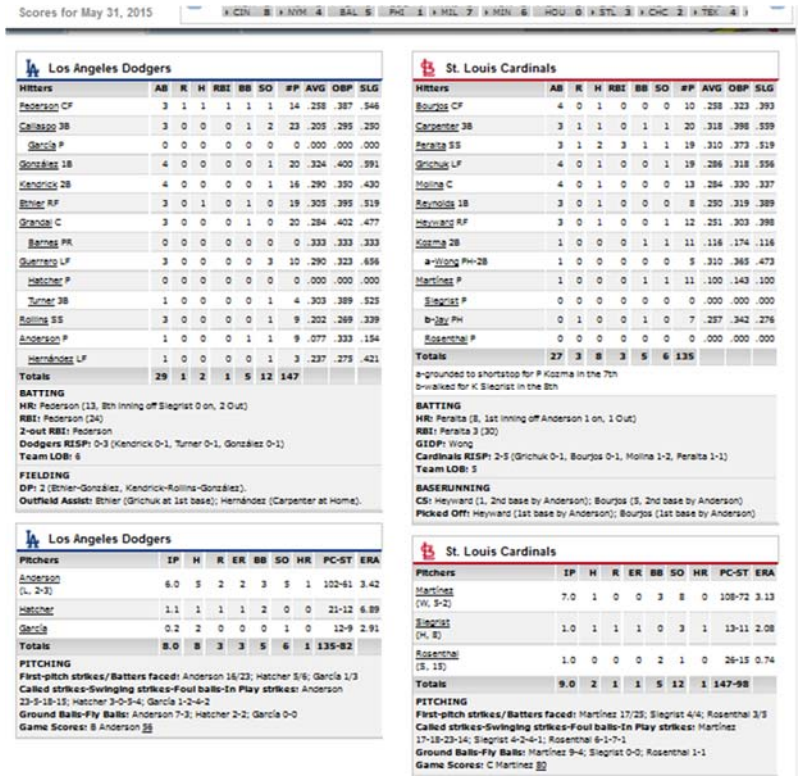


*Screenshot from Fox 2014 World Series broadcast

If I as a fan want to know after a game: Which player contributed the most? Who were the 3 Stars of the Game? Who might've contributed under the radar?

One of the existing tools I have available is the postgame box score - which I refer to as "silos of stats" - and I believe contains some deficiencies:

- Too much information … there's so much thrown at the viewer it's really too much to wade through.
- Not enough information … despite all these numbers there are critical game elements not shown (I'll provide examples later).
- Information poorly arranged … footnotes and sectioned off information require the reader to bounce between different areas.



Scores for May 31, 2015 — CIN 8 · NYM 4 · BAL 5 · PHI 1 · MIL 7 · MIN 6 · HOU 0 · STL 3 · CHC 2 · TEX 4

Los Angeles Dodgers

Hitters	AB	R	H	RBI	BB	SO	#P	AVG	OBP	SLG
Pederson CF	3	1	1	1	1	1	14	.258	.387	.546
Callaspo 3B	3	0	0	0	1	2	23	.205	.295	.250
Garcia P	0	0	0	0	0	0	0	.000	.000	.000
Gonzalez 1B	4	0	0	0	0	1	20	.324	.400	.591
Kendrick 2B	4	0	0	0	0	1	16	.290	.350	.430
Ethier RF	3	0	1	0	1	0	19	.305	.395	.519
Grandal C	3	0	0	0	1	0	20	.284	.402	.477
Barnes PR	0	0	0	0	0	0	0	.333	.333	.333
Guerrero LF	3	0	0	0	0	3	10	.290	.323	.656
Hatcher P	0	0	0	0	0	0	0	.000	.000	.000
Turner 3B	1	0	0	0	0	1	4	.303	.389	.525
Rollins SS	3	0	0	0	0	1	9	.202	.269	.339
Anderson P	1	0	0	0	1	1	9	.077	.333	.154
Hernandez LF	1	0	0	0	0	1	3	.237	.275	.421
Totals	29	1	2	1	5	12	147			

BATTING
HR: Pederson (13, 8th inning off Siegrist 0 on, 2 Out)
RBI: Pederson (24)
2-out RBI: Pederson
Dodgers RISP: 0-3 (Kendrick 0-1, Turner 0-1, Gonzalez 0-1)
Team LOB: 6

FIELDING
DP: 2 (Ethier-Gonzalez, Kendrick-Rollins-Gonzalez).
Outfield Assist: Ethier (Grichuk at 1st base); Hernandez (Carpenter at Home).

St. Louis Cardinals

Hitters	AB	R	H	RBI	BB	SO	#P	AVG	OBP	SLG
Bourjos CF	4	0	1	0	0	0	10	.258	.323	.393
Carpenter 3B	3	1	1	0	1	1	20	.318	.398	.539
Peralta SS	3	1	2	3	1	1	19	.310	.373	.519
Grichuk LF	4	0	1	0	0	1	19	.286	.318	.556
Molina C	4	0	1	0	0	0	13	.284	.330	.337
Reynolds 1B	3	0	1	0	0	0	8	.290	.319	.389
Heyward RF	3	0	1	0	0	1	12	.251	.303	.398
Kozma 2B	1	0	0	0	1	1	11	.116	.174	.116
a-Wong PH-2B	1	0	0	0	0	0	5	.310	.365	.473
Martinez P	1	0	0	0	1	1	11	.100	.143	.100
Siegrist P	0	0	0	0	0	0	0	.000	.000	.000
b-Jay PH	0	1	0	0	1	0	7	.257	.342	.276
Rosenthal P	0	0	0	0	0	0	0	.000	.000	.000
Totals	27	3	8	3	5	6	135			

a-grounded to shortstop for P Kozma in the 7th
b-walked for K Siegrist in the 8th

BATTING
HR: Peralta (8, 1st inning off Anderson 1 on, 1 Out)
RBI: Peralta 3 (30)
GIDP: Wong
Cardinals RISP: 2-5 (Grichuk 0-1, Bourjos 0-1, Molina 1-2, Peralta 1-1)
Team LOB: 5

BASERUNNING
CS: Heyward (1, 2nd base by Anderson); Bourjos (3, 2nd base by Anderson)
Picked Off: Heyward (1st base by Anderson); Bourjos (1st base by Anderson)

Los Angeles Dodgers

Pitchers	IP	H	R	ER	BB	SO	HR	PC-ST	ERA
Anderson (L, 2-3)	6.0	5	2	2	3	5	1	102-61	3.42
Hatcher	1.1	1	1	1	2	0	0	21-12	6.89
Garcia	0.2	2	0	0	0	1	0	12-9	2.91
Totals	8.0	8	3	3	5	6	1	135-82	

PITCHING
First-pitch strikes/Batters faced: Anderson 16/23; Hatcher 5/6; Garcia 1/3
Called strikes-Swinging strikes-Foul balls-In Play strikes: Anderson 23-5-18-13; Hatcher 3-0-3-4; Garcia 1-2-4-2
Ground Balls-Fly Balls: Anderson 7-3; Hatcher 2-2; Garcia 0-0
Game Scores: B Anderson 59

St. Louis Cardinals

Pitchers	IP	H	R	ER	BB	SO	HR	PC-ST	ERA
Martinez (W, 5-2)	7.0	1	0	0	3	8	0	108-72	3.13
Siegrist (H, 8)	1.0	1	1	1	0	3	1	13-11	2.08
Rosenthal (S, 15)	1.0	0	0	0	2	1	0	26-15	0.74
Totals	9.0	2	1	1	5	12	1	147-98	

PITCHING
First-pitch strikes/Batters faced: Martinez 17/25; Siegrist 4/4; Rosenthal 3/3
Called strikes-Swinging strikes-Foul balls-In Play strikes: Martinez 17-18-23-14; Siegrist 4-2-4-1; Rosenthal 6-1-7-1
Ground Balls-Fly Balls: Martinez 9-4; Siegrist 0-0; Rosenthal 1-1
Game Scores: C Martinez 80

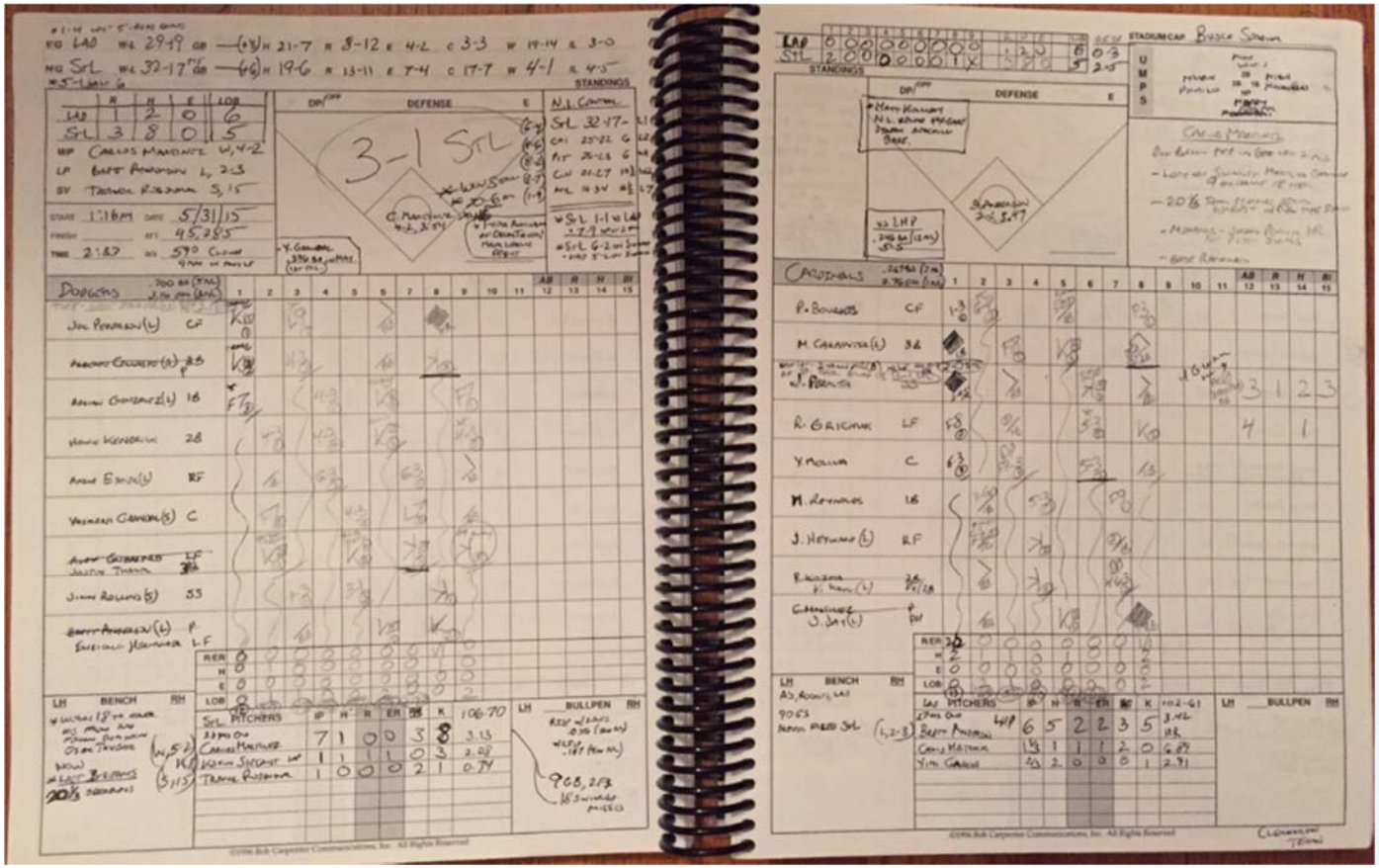
*Screenshot from MLB.com – Dodgers @ Cardinals May 31, 2015

Another tool to show players' performances is the standard symbol scorecard … which could be called baseball hieroglyphics.

I mean no disrespect because like many others I've dutifully completed many traditional scorecards and – other than proving that I could do it – I often felt the effort was a bit of a waste and that I had gleaned little or no useful numeric information from all that work. I always finished my traditional scorecarding efforts … well, with a shrug.

Traditional Symbol Scorecard:

- Best Feature is it does capture the critical elements of the game (for those who can read it).
- Too confining … issues with extra innings, player substitutions, and not enough room for text of a complicated play.
- Too much information pushed outside the margins.



*Scorecard image provided courtesy of Pat Parris of Fox Sports Midwest

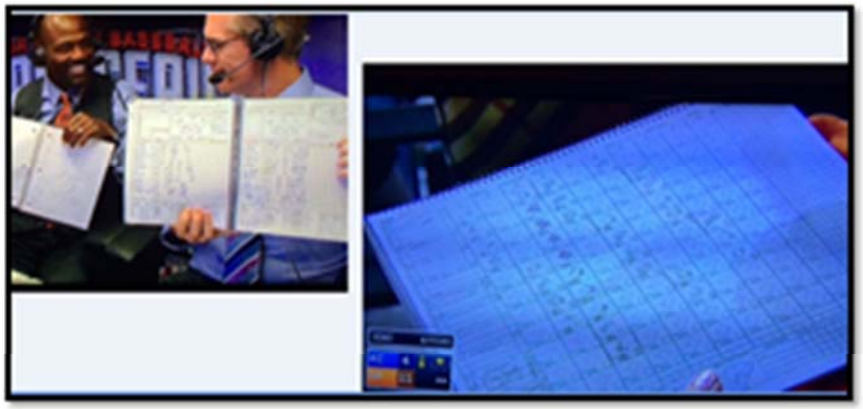
If we step back a bit and ask ourselves the question again: Who is the MVP of just a single game … we're down to these current sources at our disposal:

Box score:

Provides columns of numbers but no context of the game (no story).

Traditional Symbol Scorecard:

Provides some of the story (assuming you can read it) but falls far short on metrics.

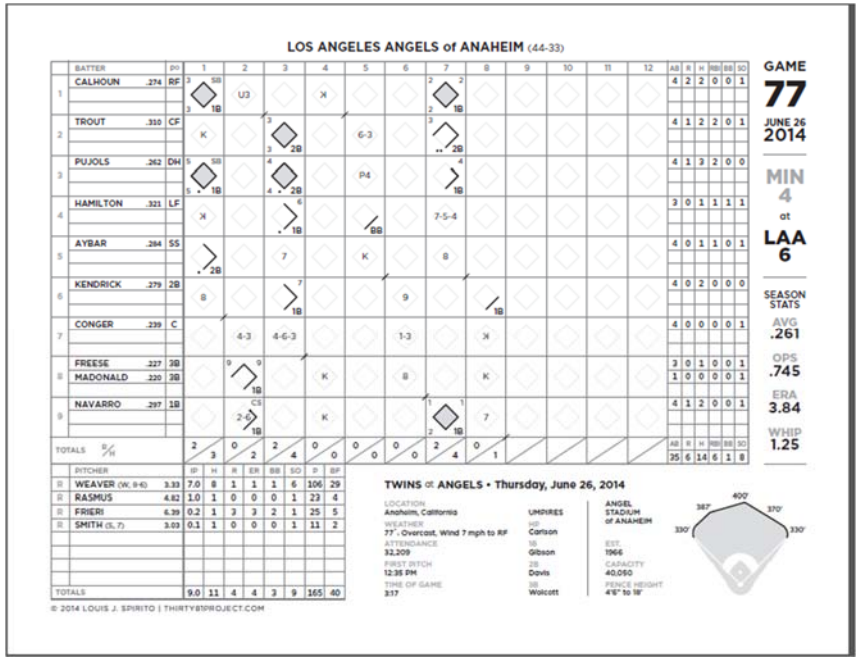


*Screenshot from Fox Broadcast 2014 World Series

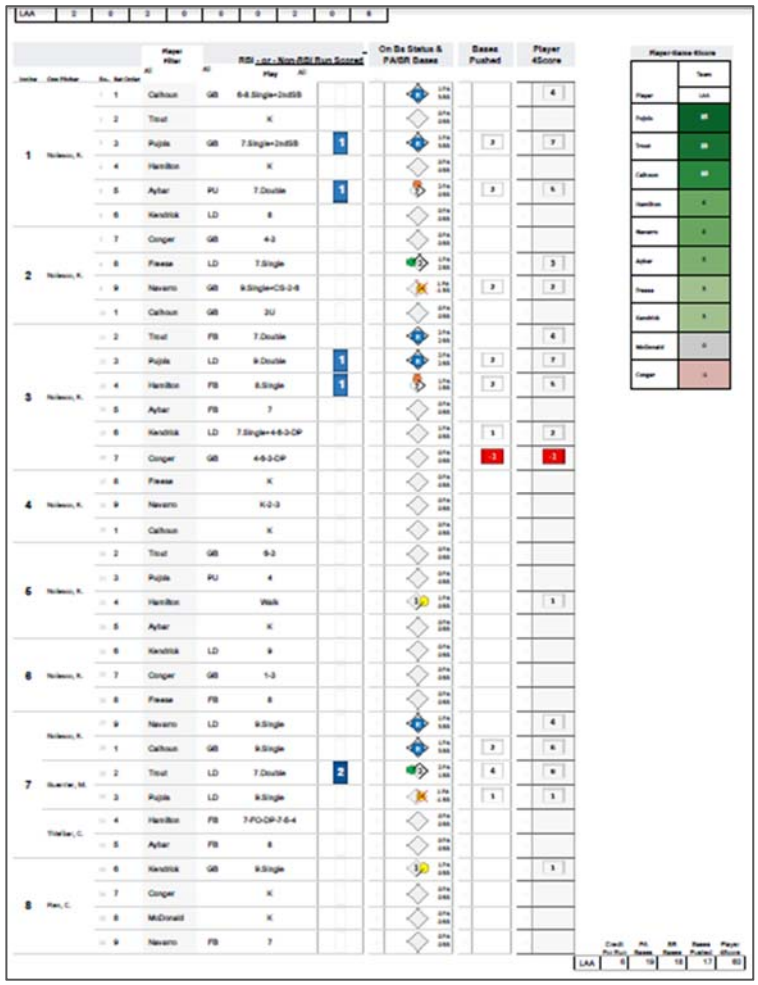
What I decided to build – initially just for my own purposes – was a Data Visualized Scorecard that would:

1. **Color code game action.**
2. **Capture and numerically represent each entire Offensive Appearance (OA) as a data line item.**
3. **Provide a clear Player Contribution summary chart.**

I used the traditional scorecard as my guide but gave it numeric value and called it 4Base Scoring.



*Screenshot from AngelsWin.com – scorecard by Lou Spirito



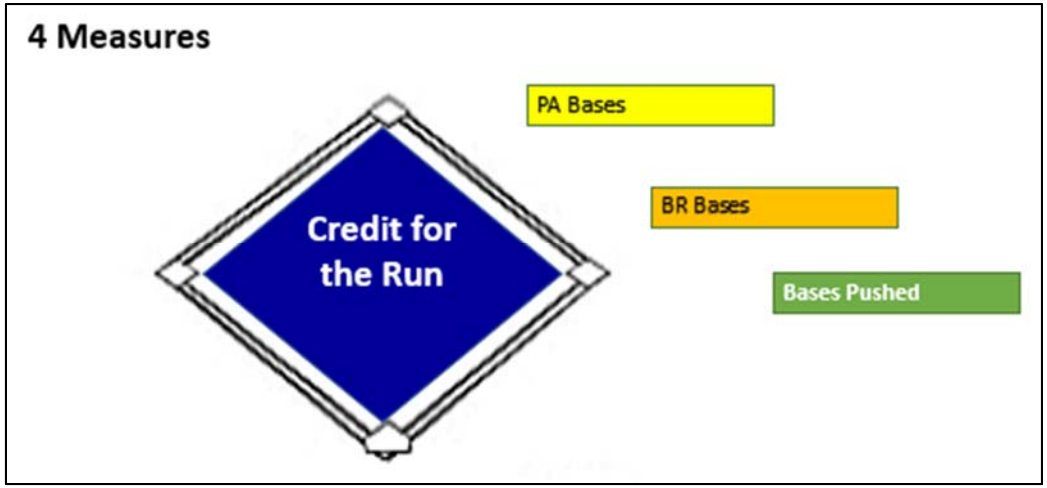
*4BaseScore.com

4 Base Scoring defined:

The extent each player contributes to advancing himself and/or lead runners around 4 Bases.

It's a point system that tallies **4 Measures**:

- ***PA Bases*** – bases player advanced on his own PA
- ***BR Bases*** – bases player advanced once on base
- ***Bases Pushed*** – total number of bases player advanced lead runners
- ***Credit for the Run*** – typically RBI but in non-RBI situation Credit for the Run goes to the runner



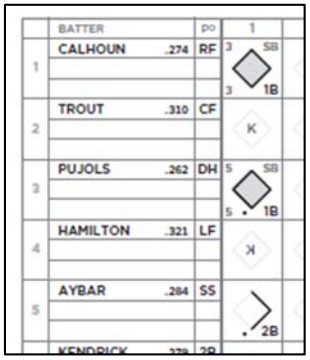
Other features I wanted in my scorecard were:

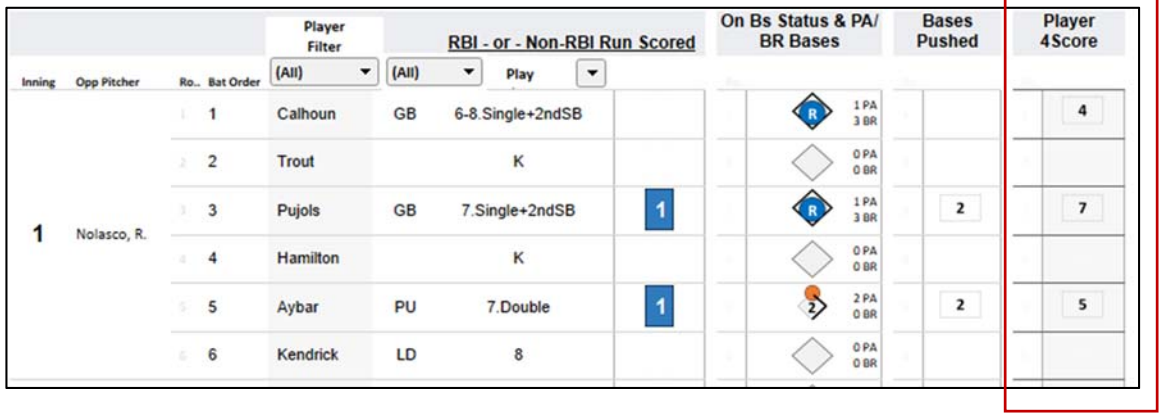
- Scorecard should read top to bottom
- Match pitchers to batters
- Available space for meaningful Play Text
- Tally and visually show summarized Player Contribution Table

When I realized I could numerically represent the traditional scorecard I gained a new appreciation for it and for those who have kept it alive for over 100 years. I respect the wisdom and logic in what I see as the 4 key components that have always been part of it. I tally each drawn line of a symbol scorecard to count a player's progression around the bases, plus the impact the batter has on runners already on base, and I award an additional point for RBI/Credit for the Run.

4Base scoring seeks to transform the hieroglyphics of the symbol scorecard into a numerical representation showing players full offensive contributions; thus converting the symbols into stats.

So the symbolic view on the left – 1st inning of a LAA vs MIN game from 2014 - translates to the numeric representation on the right:

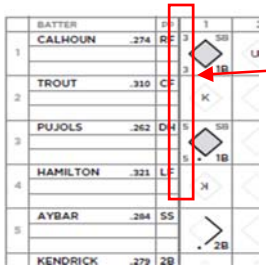




The numeric breakdown of the Player 4Scores for this 1st Inning are:

Player	Play Text	PA Bases	BR Bases	Bases Pushed	Credit for the Run	**Player 4Score**
Calhoun	6-8.Single+2ndSB	**1**	**3**			**4**
Trout	K					**0**
Pujols	7.Single+2ndSB	**1**	**3**	**2**	**1**	**7**
Hamilton	K					**0**
Aybar	7.Double	**2**		**2**	**1**	**5**
Kendrick	8					**0**

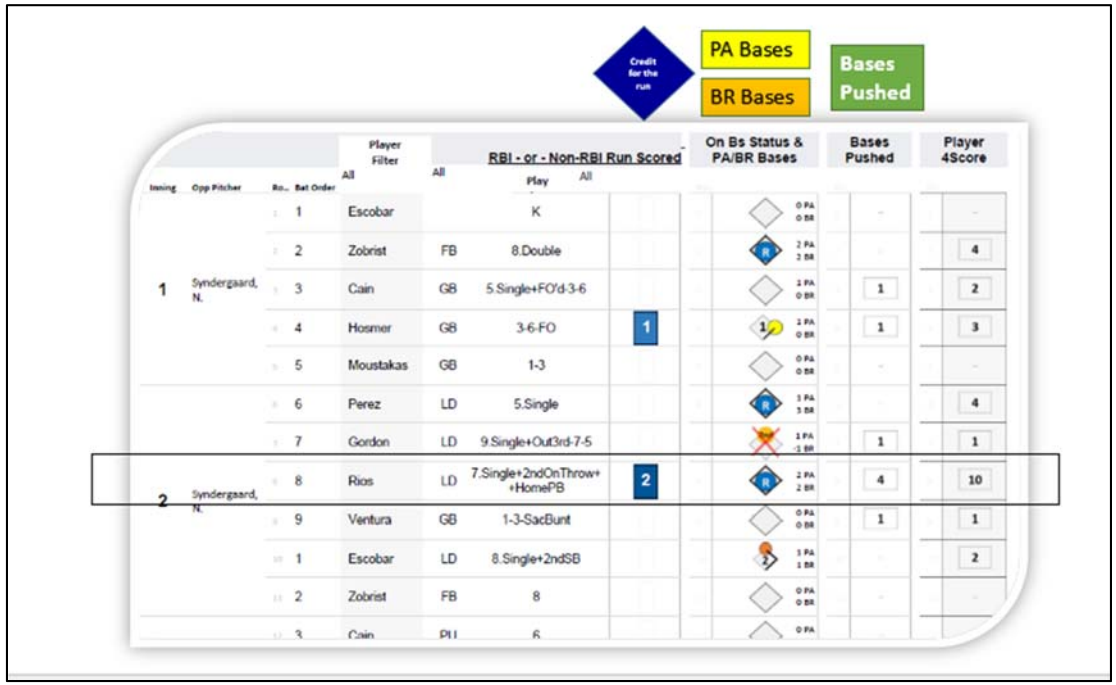
Note 4BaseScore "Bases Pushed" which gives appropriate credit for Pujols and Aybar advancing runners … barely noticeable in the symbol scorecard.

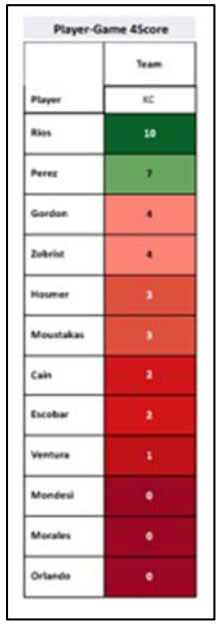


A clipped example of a 4Base scorecard from the 2015 World Series is below. Note how the 4Base measures are captured on each Offensive Appearance (OA) line item. As an example, I've highlighted Rios' 2nd Inning Offensive Appearance below. The OA captures the player's activity from "batter's box to dugout".

Also, note the Player 4Score summary chart that is refreshed throughout the game and provides end of game MVP, etc.

We'll go into detail on the individual pluses and minuses next.





At this point I need to introduce some specific terms and what they capture in 4Base scoring:

Productive Out – obvious … but since this is a big part of the methodology it bears noting that 4Base captures **all** productive outs whether or not they're officially deemed "sacrificial". It's surprising how many total productive outs there were for the 2 prototype teams. I'll present those numbers shortly.

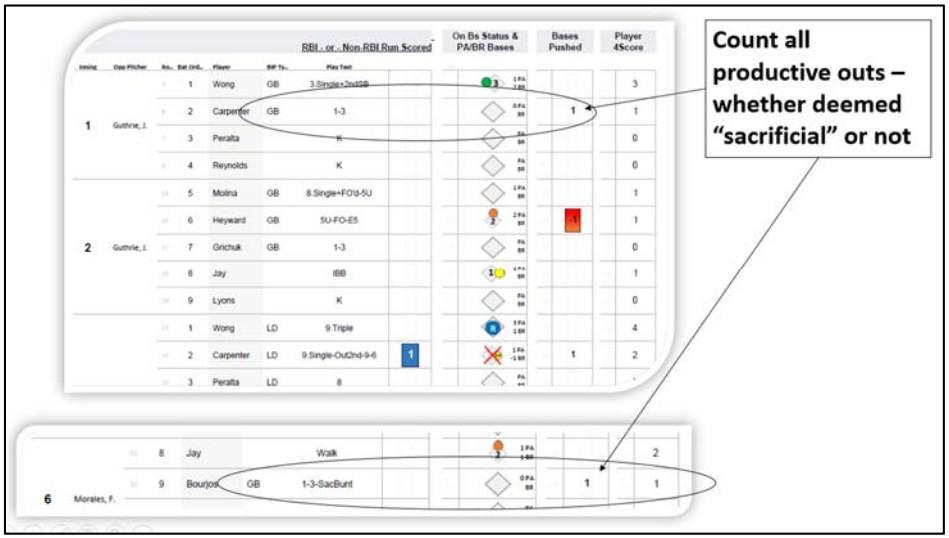
Predator Out – opposite of a Productive Out and the 4Base term for batter outs that remove lead runners. We all know GDP is the commonly captured event but Force Outs of lead runners is also common and these outs, and their impact, are not currently captured in standard stats.

Negative Base Running – Caught Stealing is of course a standard stat and 4Base captures it as well, but there are several other base running outs which are not captured/incorporated into standard stats but are, like Predator Outs, a larger number than realized.

Let's take each of these concepts and provide specific and detailed examples from actual games from the 2015 season and playoffs.

Productive Outs – main point is that all productive outs are captured and counted.

The two occurrences in the game below do not receive the same standard stats treatment but served the exact same purpose. Carpenter's ground ball to the pitcher in the 1st inning advanced Kolten Wong to 3rd and Bourjos' ground ball Sac Bunt to the pitcher later in the game advanced Jon Jay to 2nd.



Whether or not you agree with the *strategy* of sacrificial behavior by teams, I've found it to be a large part of the game and if you look only at the standard stats you're definitely not seeing the entire picture. For the two prototype teams (LAA and STL) the productive outs breakdown is as follows:

	Official Sacrifices (Sac Bunts & SF)	Total 4Base Score Productive Out Occurrences	Total Bases Pushed via Productive Outs
2015 LAA	77	202	249
2015 STL	81	223	281

In addition to the significant difference between official sacrifices and total productive outs shown above, note the number of bases pushed which standard sacrifice stats don't capture at all.

It's important to note here that 4Base Scoring is not intended to reward sacrificial behavior but simply to ***count*** it. To recognize the numeric impact of ***all*** productive outs within the game scorecard!

2015 Prototype Team results - The tables below provide Productive Out Occurrences and the Bases Pushed impact by Player:

2015 Los Angeles Angels – 4Base Score Productive Outs

Player	Occurrences	Sum of Bases Pushed
Pujols	29	37
Aybar	26	31
Giavotella	21	25
Calhoun	16	18
Perez	14	19
Trout	13	15
Cron	12	14
Joyce	12	16
Freese	10	10
Featherston	9	10
Murphy	7	9
Jackson	5	7
Iannetta	5	6
Victorino	4	5
Gillaspie	4	5
Robertson	3	3
Cowgill	2	3
Cowart	2	3
DeJesus	2	3
Navarro	2	2
Marte	1	1
Green	1	3
Nieuwenhuis	1	3
Heaney	1	1
Grand Total	**202**	**249**

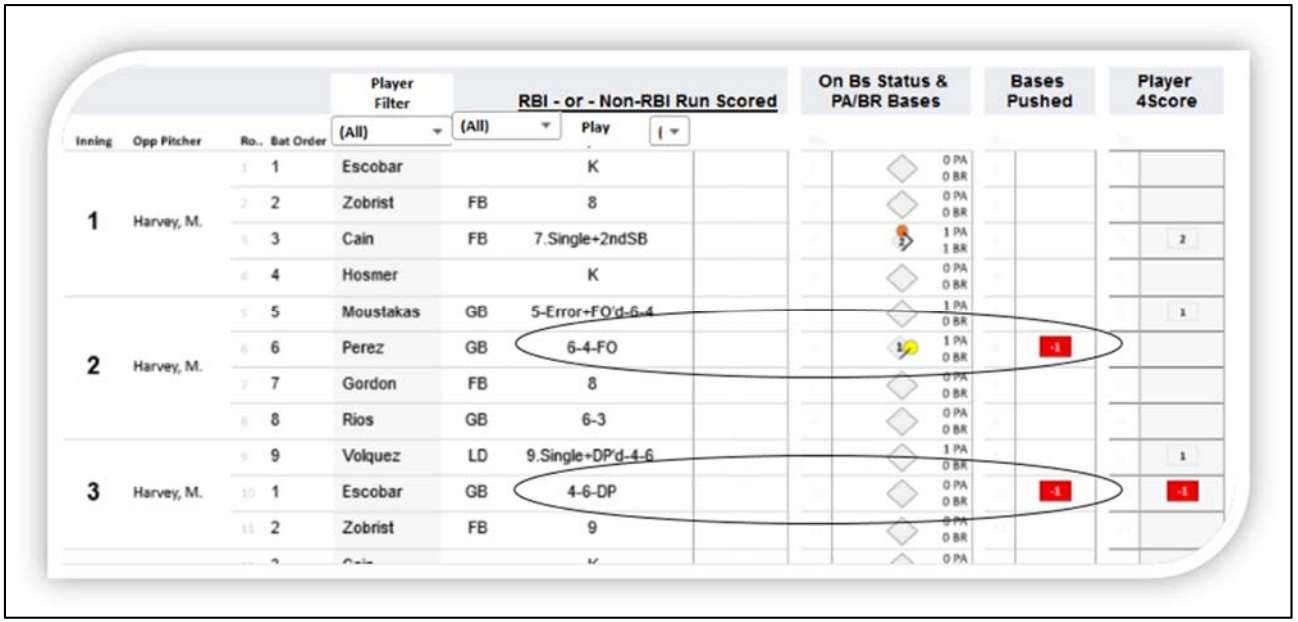
2015 St. Louis Cardinals (regular season) – 4Base Score Productive Outs

Player	Occurrences	Sum of Bases Pushed
Molina	31	43
Heyward	21	27
Peralta	18	24
Carpenter	17	18
Holliday	14	18
Wong	15	17
Cruz	11	15
Reynolds	10	13
Wacha	7	11
Bourjos	8	10
Jay	9	10
Grichuk	6	8
Martinez	5	7
Adams	6	7
Piscotty	6	7
Lackey	6	7
Garcia	5	6
Lynn	5	6
Pham	4	6
Kozma	5	5
Moss	3	4
Garcia, G.	2	3
Lyons	2	2
Villanueva	2	2
Easley	1	1
Wainwright	1	1
Scruggs	1	1
Cooney	1	1
Johnson	1	1
Grand Total	**223**	**281**

Predator Outs

Earlier I mentioned the impact of "Predator Outs" which captures occurrences where lead runners are removed from the base path.

Ground ball double plays are the most obvious example of Predator Outs – and of course are captured in standard stats – but a standard force out of a lead runner is also a Negative Bases Pushed occurrence. The scorecard example below shows how I visually and numerically capture this critical (negative impact) event.



Below is the summary of Predator Outs for 2015 prototype teams:

	GDP	Total 4Base Score Predator Out Occurrences
2015 LAA	116	159
2015 STL	128	195

The tables below provide Predator Out Occurrences by Player:

2015 Los Angeles Angels – 4Base Score Predator Outs

Player	Total Predator Out Occurrences
Aybar	20
Pujols	18
Freese	17
Trout	13
Giavotella	13
Calhoun	11
Cron	10
Iannetta	10
Joyce	9
Perez	8
Navarro	6
Featherston	5
Murphy	4
Green	3
Victorino	2
Kubitza	2
Cowart	1
Santiago	1
Robertson	1
Jackson	1
Cowgill	1
Heaney	1
DeJesus	1
Krauss	1
Grand Total	**159**

2015 St. Louis Cardinals – 4Base Score Predator Outs

Player	Predator Out Occurrences
Heyward	34
Peralta	29
Wong	20
Molina	16
Holliday	11
Piscotty	10
Jay	10
Reynolds	9
Carpenter	8
Cruz	8
Grichuk	6
Bourjos	6
Adams	5
Kozma	5
Moss	4
Martinez	3
Garcia, G.	3
Lackey	2
Lynn	2
Scruggs	1
Easley	1
Johnson	1
Pham	1
Grand Total	**195**

The term **Negative Base Running** (Negative BR) and the accounting for it in 4Base scoring resulted from the need to numerically represent a situation where a player essentially removes himself from the bases via a base running out.

This concept, and the negative numbers that are shown on the scorecard, might appear unfairly punitive; after all maybe aggressive base running is the team's philosophy, probably the base runner was obeying his 3rd base coach, or perhaps he was drawing a throw to advance a teammate. It bears repeating that the objective of 4Base scoring is to numerically represent what actually happened "from batter's box to dugout" …

Therefore, I'm not casting judgement on an attempt to advance on the bases, I'm simply **counting** it. I'm noting the numeric impact of that failed attempt.

Remember, we're keeping a scorecard (you'd certainly show this occurrence on your scorecard) so – in the example below - we visually show that the player was safe at 2nd but failed in his attempt to make it to 3rd so he incurs a BR of -1 and the "Bases Impact" of his failed attempt is a -2 (he was on 2nd, now he's not).

Caught stealing is the obvious Negative BR type stat and on baseball websites it's deemed important enough to merit a column on "Page 1" stats. It's typically just a footnoted item in the base running section of a box score.

Surprisingly, CS accounts for a relatively small portion of all base running outs. 4Base scoring includes Caught Stealing (of course) but also captures all other Base Running outs. For example: attempting but failing to advance an extra base, getting caught off base on a Line Out or Fly Out, a standard Pick Off.

Note in the table below that CS accounts for only 35% and 30% respectively of the 2015 Cardinals and Angels base running outs and yet no standard stat (that I'm aware of) takes into account these other base running outs; if you look at the BR outs in terms of "bases lost" the impact is even higher!

	Caught Stealing	4Base Scoring Total Negative BR occurrences (includes CS)	Bases Impact of Negative BR
2015 LAA	34	113	-136
2015 STL	38	107	-127

The following tables provide the breakdown by Player of Negative Base Running (2015 LAA and STL).

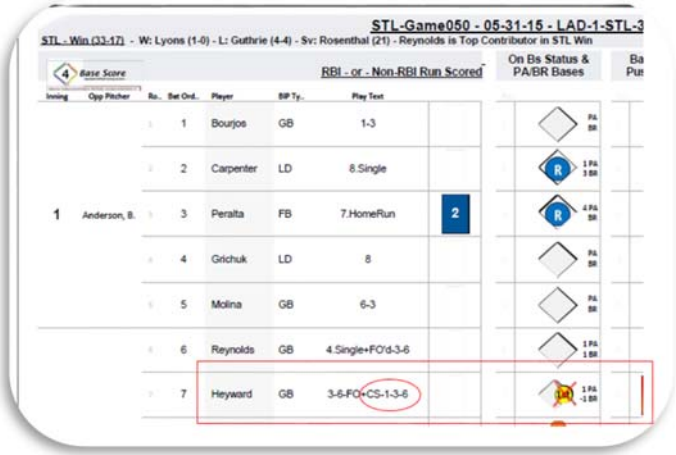
2015 Los Angeles Angels – 4Base Score Negative BR Outs

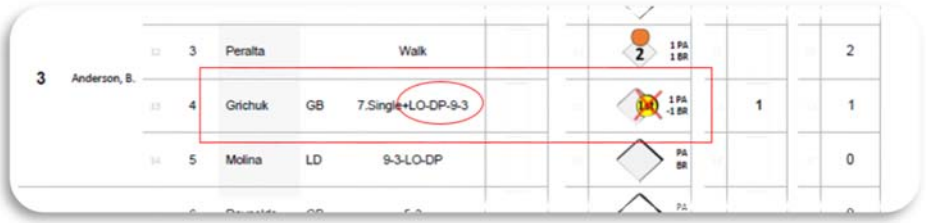
Player	Negative Base Running Outs (includes CS)	"Bases" impact of Negative BR Outs
Aybar	18	-20
Giavotella	13	-16
Trout	14	-15
Calhoun	11	-12
Pujols	9	-11
Freese	7	-9
Cron	5	-8
Featherston	6	-7
Joyce	5	-6
Murphy	4	-6
Perez	3	-5
Gillaspie	2	-4
Iannetta	3	-3
Navarro	2	-2
Wilson	1	-2
Nieuwenhuis	2	-2
Perez-Featherston	1	-1
Freese-Featherston	1	-1
Robertson	1	-1
Joyce-Cowgill	1	-1
Butera	1	-1
Green	1	-1
Freese-Cowart	1	-1
Kubitza	1	-1
Grand Total	**113**	**-136**

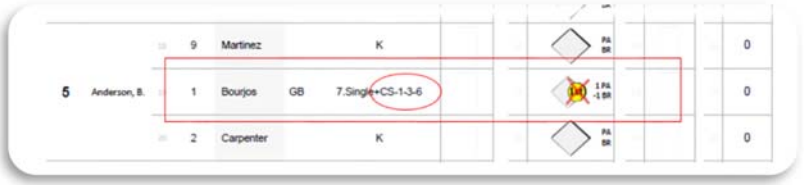
2015 St. Louis Cardinals – 4Base Score Negative BR Outs

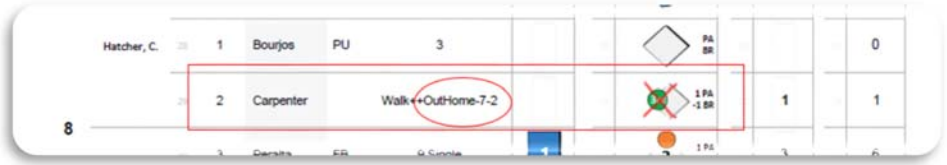
Player	Negative Base Running Outs (includes CS)	"Bases" Impact of Negative BR Outs
Carpenter	14	-18
Heyward	12	-16
Wong	14	-15
Peralta	11	-11
Grichuk	7	-10
Reynolds	8	-10
Bourjos	8	-9
Jay	6	-7
Holliday	4	-5
Molina	5	-5
Piscotty	5	-5
Pham	2	-4
Moss	2	-3
Peralta-Kozma	2	-2
Lackey	1	-1
Adams	1	-1
Cruz	1	-1
Reynolds-Bourjos	1	-1
Kozma	1	-1
Peralta-Garcia, G.	1	-1
Johnson	1	-1
Grand Total	**107**	**-127**

I'd like to show one more page highlighting the current lack of accounting for base running outs: During one 2015 Cardinals game there were **4 Negative BR** occurrences accounting for **6 "lost bases"**: CS in the 2nd inning, Caught of 1st on a LO-DP in the 3rd, CS in the 5th, and a thrown out at home in the 8th.

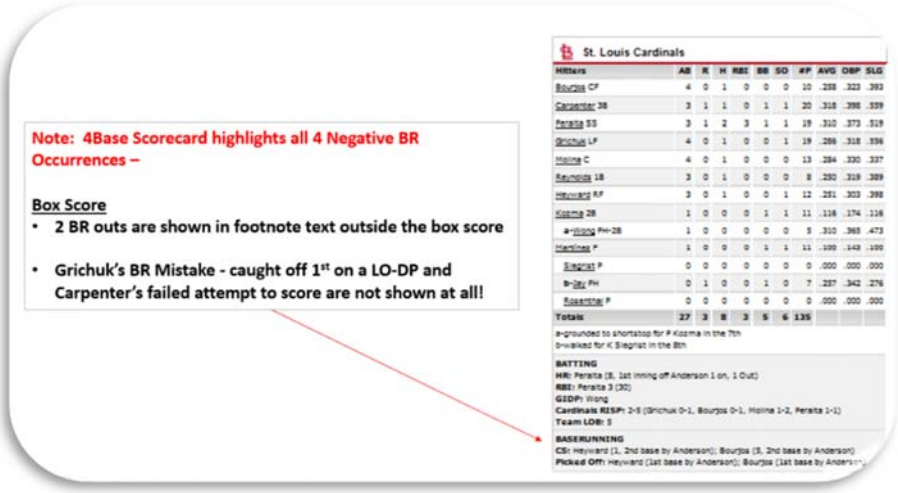




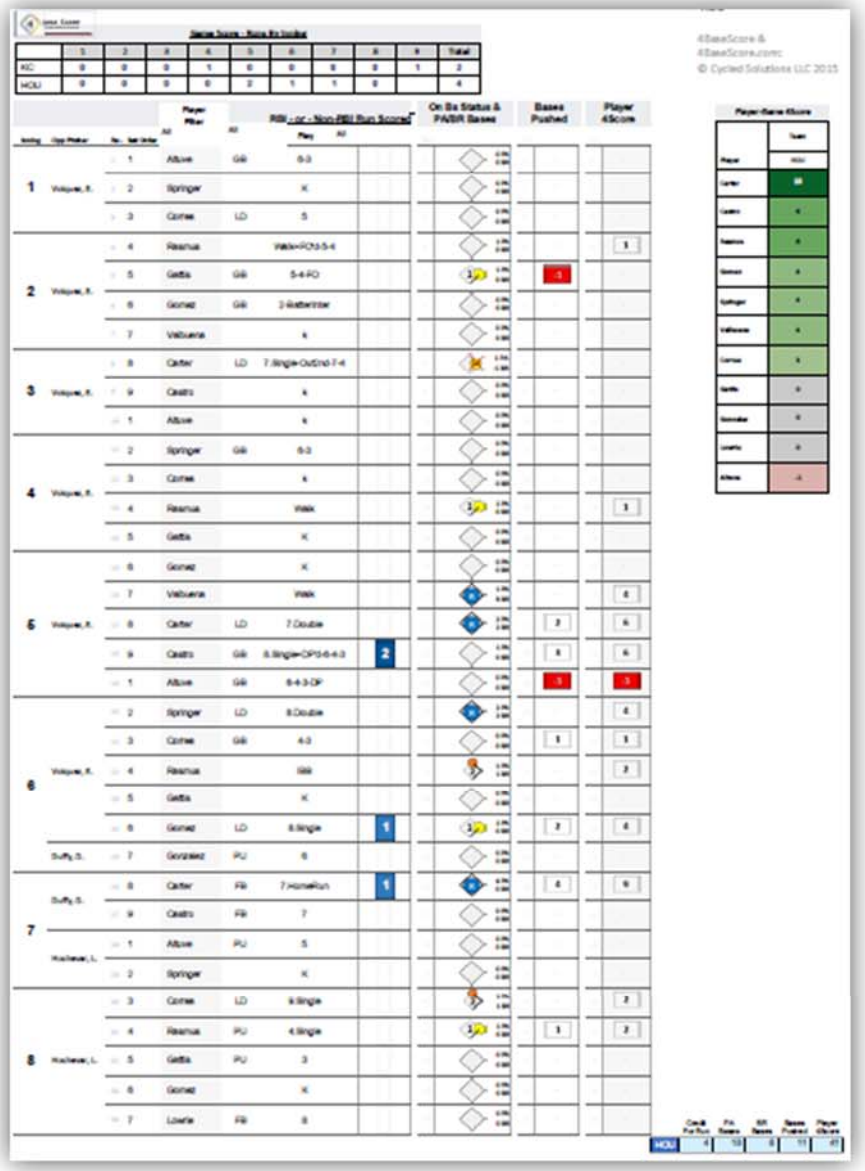


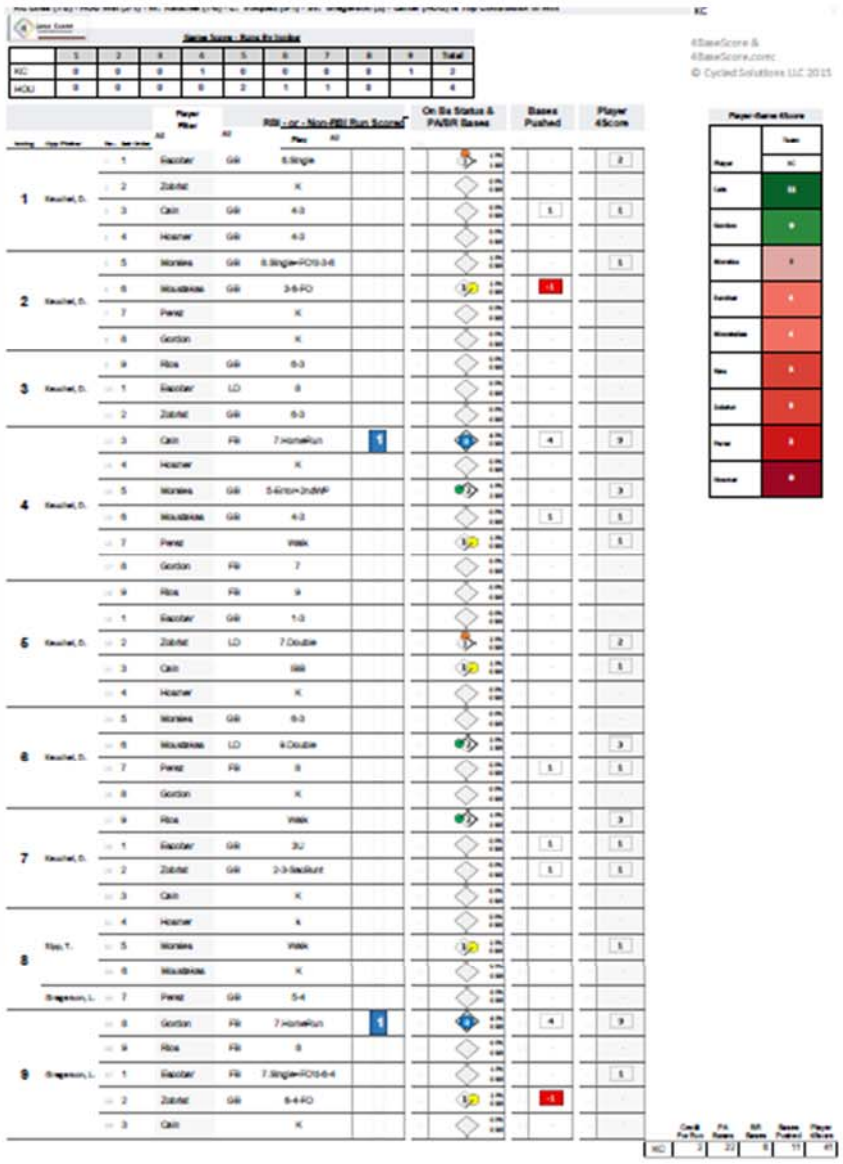


Interesting to note in the box score 2 BR outs are footnote items, and Grichuk's LO-DP BR error and Carpenter's failed attempt to score aren't shown at all!



Now that we've discussed the unique elements of 4Base scoring let's look at a game example. The screenshots below are from ALDS Game 3 – HOU 4 vs KC 2





Aggregated 4Base Score Data - At this point I'd like to circle back to the original question and apply it to the **2015** Cardinals: Who was the Team MVP?

But first, let's start by looking at existing metrics using 2 standard stats and 1 advanced metric used almost universally (WAR).

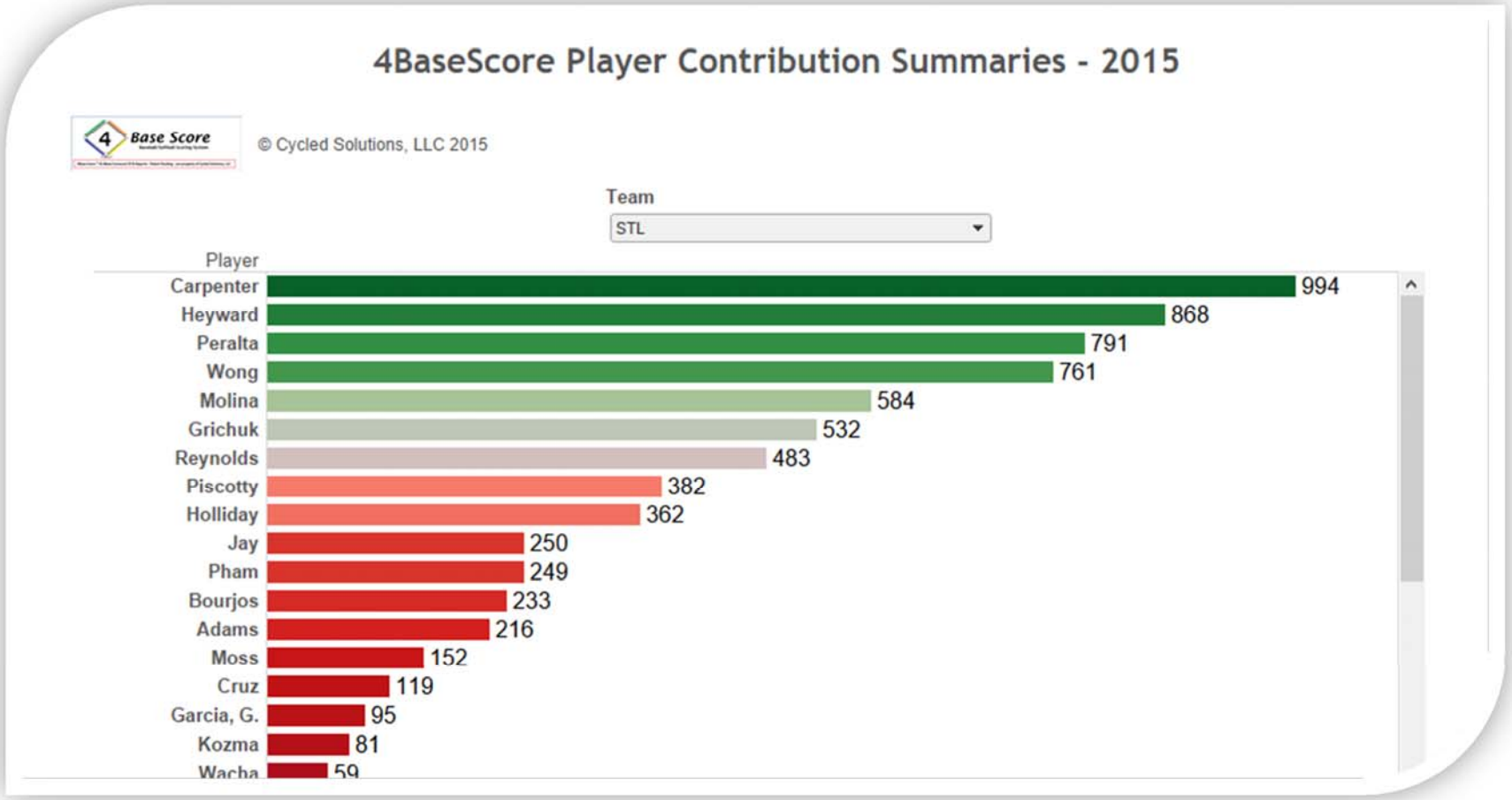
Note there is no complete agreement (1-5 ranking) among them. It was this circumstance in 2013 that motivated my effort and you'll see on the next page how these players fared in 4Base Scoring.

Rank	Player	OPS
1	Grichuk	.877
2	Carpenter	.871
3	Heyward	.797
4	Peralta	.745
5	Wong	.707

Rank	Player	Batting Avg
1	Heyward	.293
2	Grichuk	.276
3	Peralta	.275
4	Carpenter	.272
5	Wong	.262

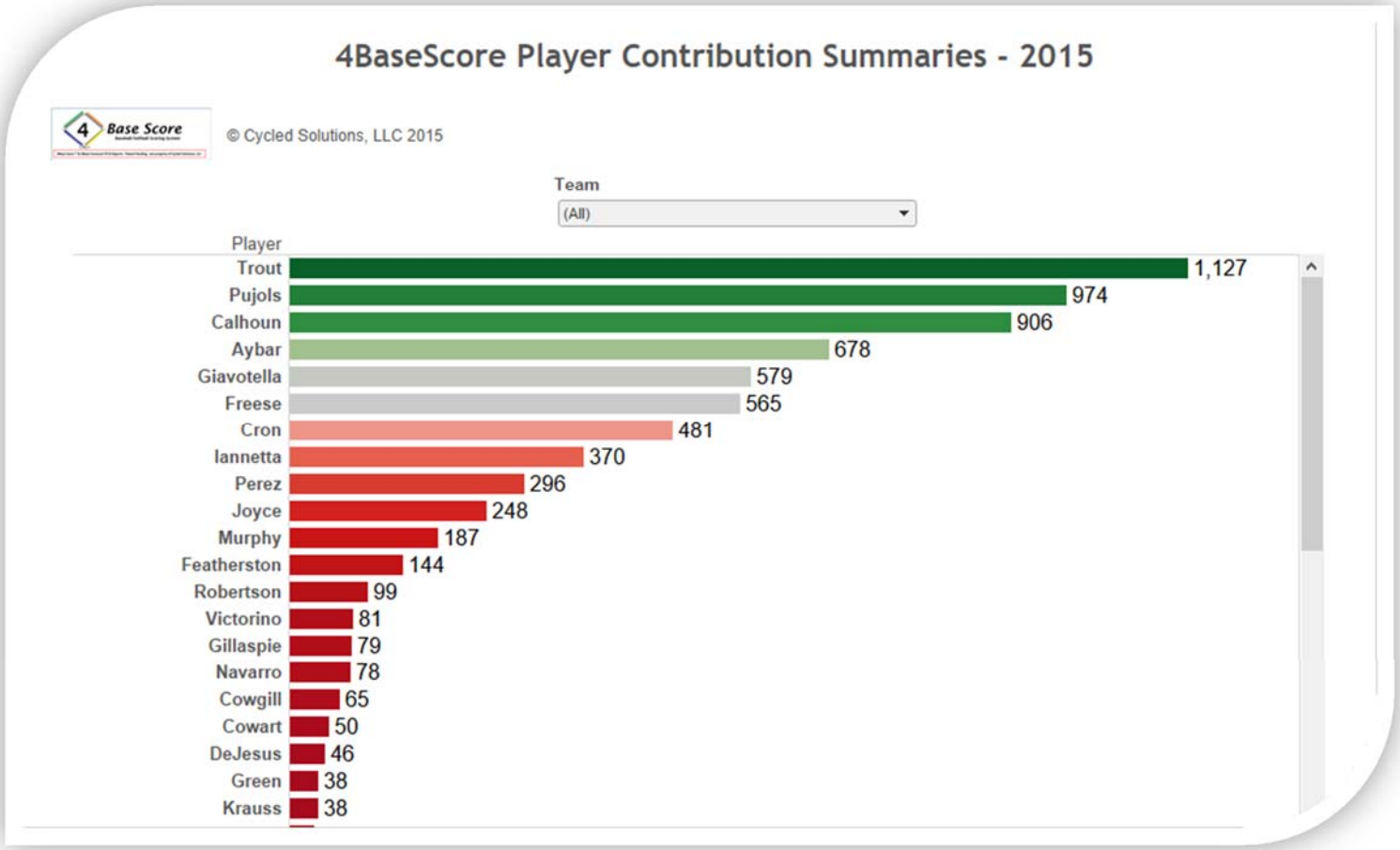
Rank	Player	WAR (per Baseball Reference)
1	Heyward	6.5
2	Carpenter	3.9
3	Grichuk	3.1
4	Wong	2.2
5	Peralta	1.8

There is a clear 2015 MVP in 4Base Score aggregate results: **Matt Carpenter**



- An interesting note is that Heyward who came in 2nd was in 4th place as late in the season as August 19. His late surge in the final 5-6 weeks of the season, combined with declines by both Peralta – who was in 2nd place for much of the season - and Wong resulted in Heyward's 2nd place 4Base Score finish.
- Note also that Grichuk, who was in the top 3 of the standard stats measures, comes in 6th in 4Base aggregate results. Because 4Base is cumulative the measure organically factors in durability. Grichuk's 2015 games played was only 103 so he'd have to produce a lot to overcome the basic fact that he appeared in fewer games … the fact that he's a slugger helped him greatly in 4Base (as it does in standard stats).

It will come as no surprise that Mike Trout is LAA MVP so I'm providing the information below simply to show his team's full 4Base Scoring results:



Miscellaneous …

Because at this point I've 4Base scored so many games – 3 full seasons of LAA & STL plus miscellaneous other games - I have a sizable dataset:

4Base Scorer's Stats - Estimated As of Nov-2015

4BaseScore: Games Scored	2015	2014	2013	Total
Prototype team: LAA Regular Season	162	162	162	486
Prototype team: STL Regular Season	162	162	162	486
2013 Postseason (STL games only)			17	17
2014 Postseason - All Teams		30		30
2015 Misc games (other teams) estimated	5			5
2015 Postseason *	31			31
	360	354	341	1055

Total 4BaseScore Data Records calc'd @ Games Scored x Avg OA line items (38)	38	40,090

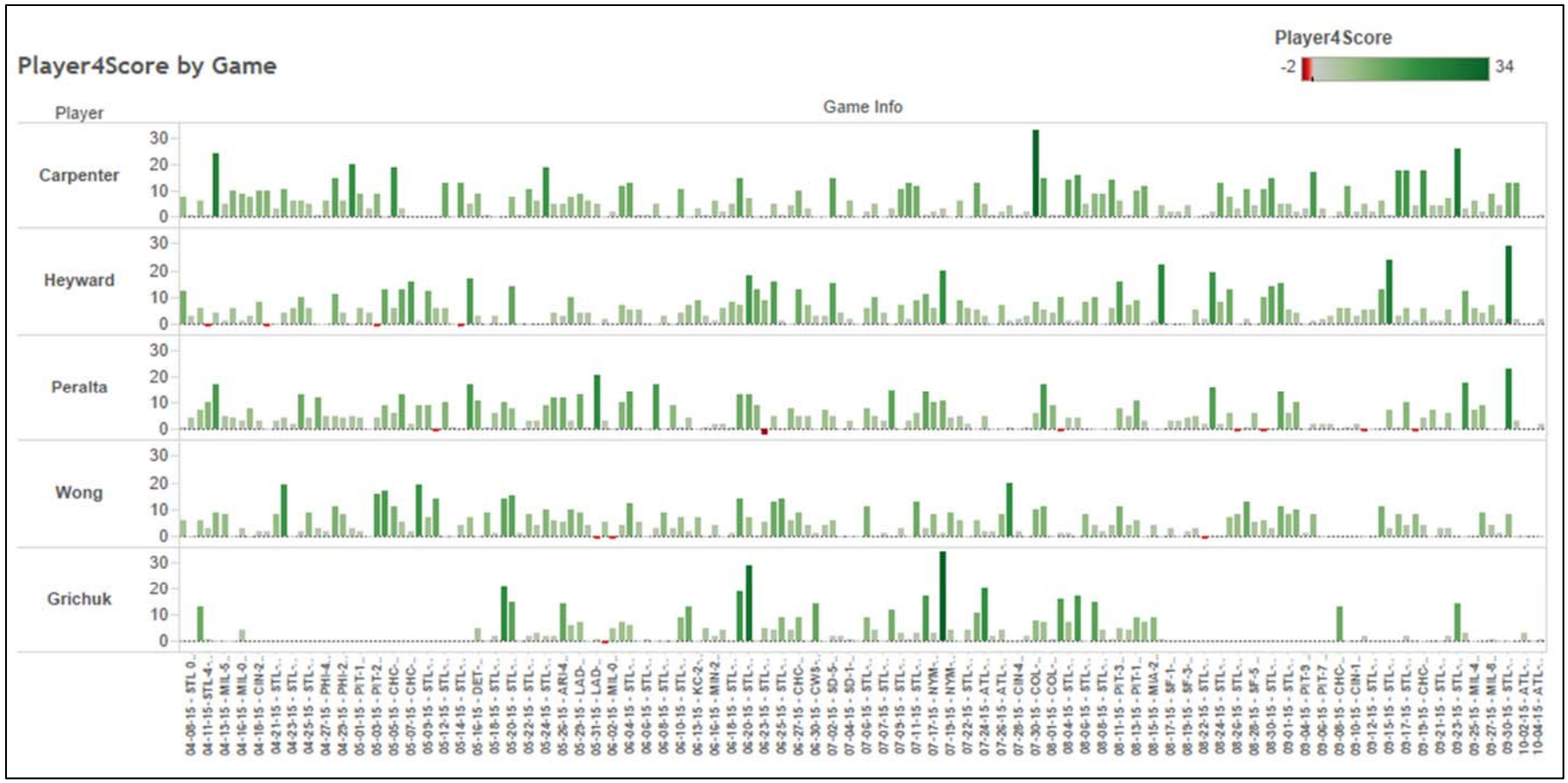
** As of Nov-2015 there are 5 Div Series games that are partially scored (advancing team only)*

I plan to eventually score all games

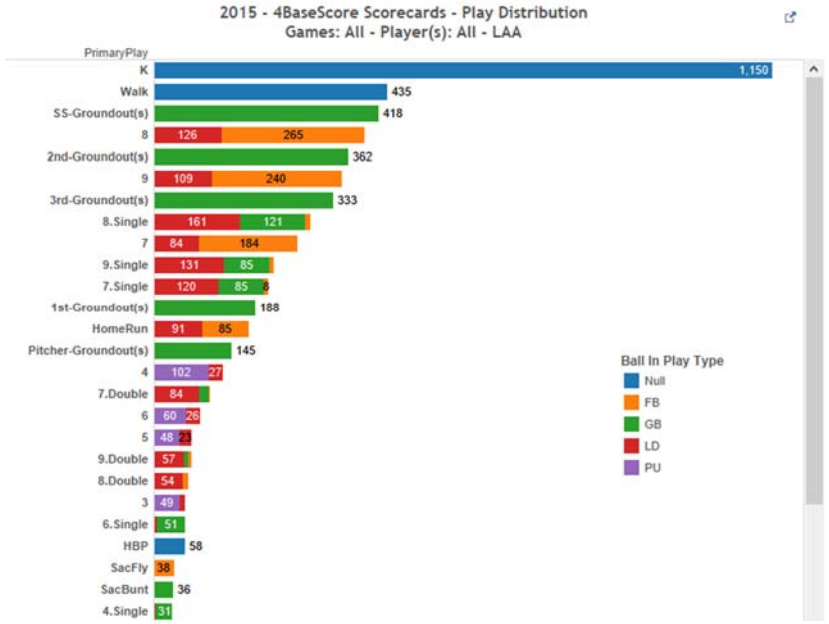
- Note for LAA and STL games I did not always have time to score the opponents' side of the game. 2013-2014 data is almost exclusively LAA & STL only and for 2015 I'd estimate approximately 1/2 of LAA & STL games scored also include opponents scorecard.

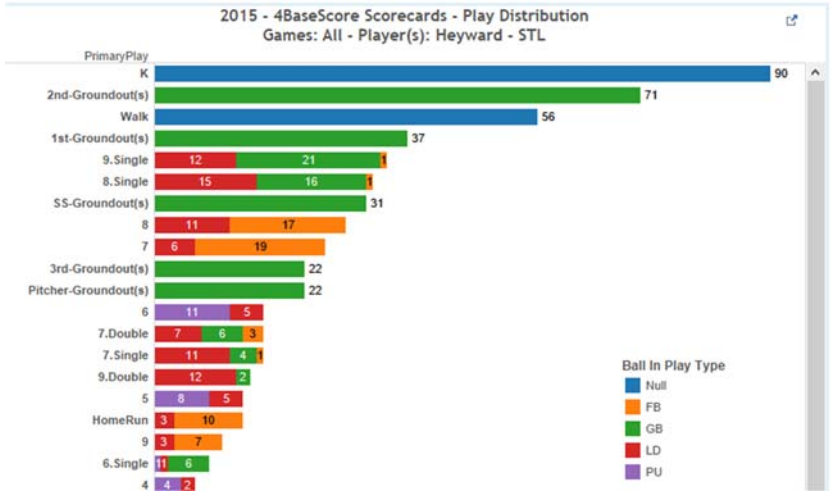
Having my own data set has allowed me to build many data visualized views, just a few of which are shown on the following pages:

4Base score – by Game spread – 2015 Cardinals - 5 players noted on earlier page



Play Distribution charts – built from Play Text field of the scorecards:





There’s something special about keeping a baseball scorecard. By doing so we commit ourselves to paying attention to the details. We recognize productivity that many fans don’t notice at the time ... or forget soon after.

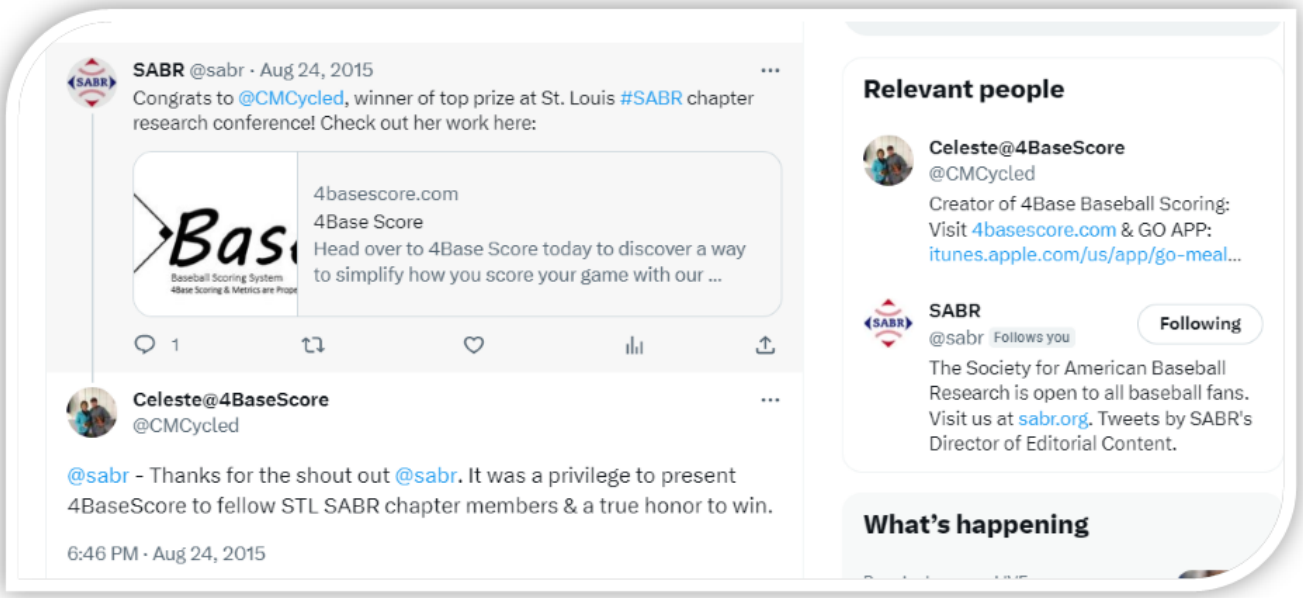
By scoring we're saying to players when you contribute, and ***in every way*** you contribute, we'll document it. And, in 4Base Scoring, we'll count it.

Thank you for your time.

Celeste Czarnecki is the creator of 4Base Scoring.

In addition to data visualization work, her career as a Data and Systems Analyst has spanned more than 30 years, with a specialization in financial systems and reporting. She has been an employee of, or a Data Consultant for, three global corporations in St. Louis.

This presentation won first place at the 2015 STL SABR Analytics Conference.



4Base Scoring - Update 2016-2023

- ***Created the 4Base paper scorecard***
- ***Created 4Base Summary Tool for "at a glance" view of players' contributions***
- ***Devised Phase 1 method of translating paper scoring to digital views of game results and 4Base metrics.***