Pitch Selection: Utilizing Statcast Inflight Metrics to Redefine How We Evaluate Swing Decisions

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Why Do We Care?

Importance of Good Swing Decisions

- Good Decisions Gives Batters the Best Chance to Hit Bad Pitches
- Improves Hitter's Ability to Get Into a Favorable Count

Impact of Run Expectancy By Count

2024 Delta Run Expectancy By Count				
S\B	0	1	2	3
0	0	0.032	0.088	0.187
1	-0.038	-0.016	0.030	0.125
2	-0.089	-0.068	-0.037	0.050

Factors Influencing Swing Decisions

- Pitch Characteristics
  - Type, Location, Movement, Tunneling
- Game State/Situation
- Count (2 Strikes, 3 Balls, etc.)

Current Models

- [SEAGER: Used By Baseball Prospectus](#)

- [Decision Value By Thomas Nestico](#)

- Traditional Stats

  - Z-Swing%

  - O-Swing%/Chase Rate

- The Issue:

  - These stats evaluate swing decisions based on where the ball ends up, not the point where the batter must make a decision
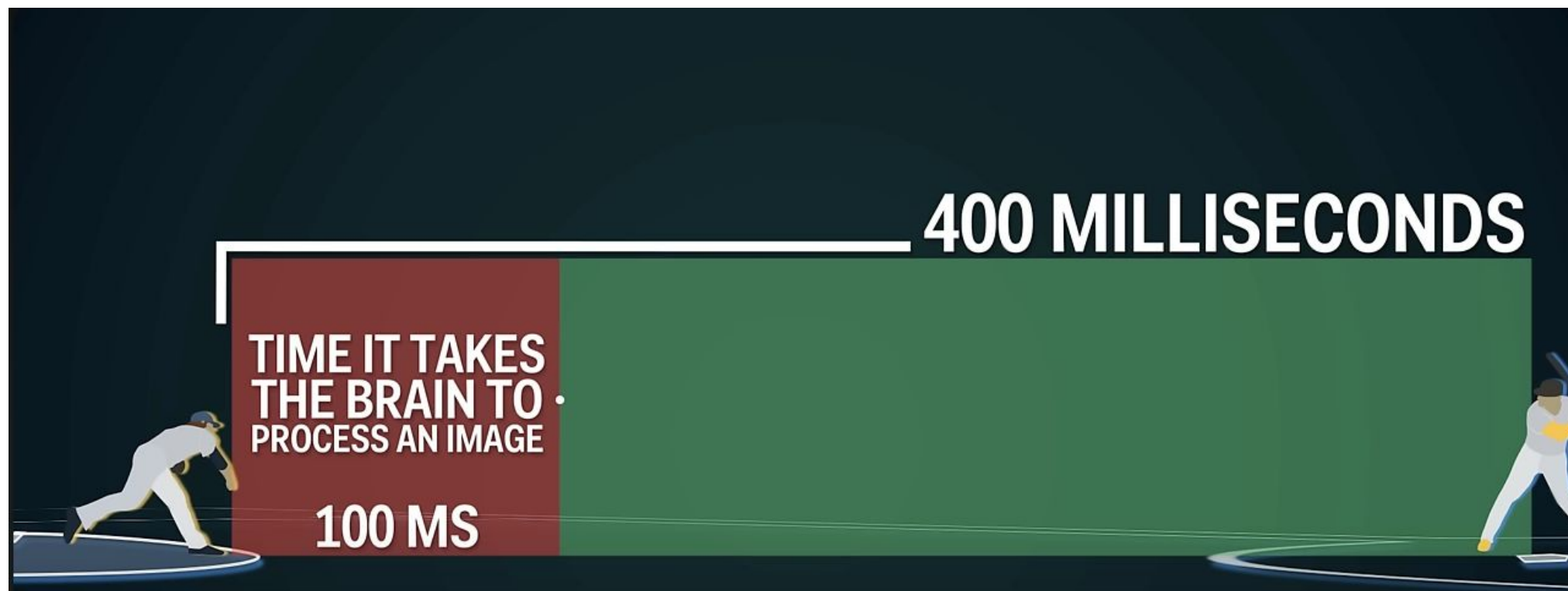
What Science Says

Youtube/Insider Science

What Science Says

- Statcast Supplies Velocity & Acceleration Vectors at 50 feet from home plate

- Using simple physics, we can use these measurements to project the ball position after 100 ms

  - $x_f = release\_position + (v_{xr} * 0.1) + (0.5 * a_x * 0.1^2)$

- Utilize Ball Position & movement at 100 ms to predict where the pitch will cross the plate using a ML model

Methodology

Making a Good Pitch Selection Requires:

1. Contact ⟶ **Run Value**

2. Damage ⟶ **xwOBACON**

Quantifying Traits:

1. Model Swing Probability

2. Model Whiff Probability (Given Swing)

3. Model xWOBACON

Pitch Characteristics

- Velocity
- Pitch Break

Location

- Expected Pitch Location
- Attack Zones (Heart, Shadow, etc.)

Pitch Tunneling

- Euclidean distance after 100 ms
- Euclidean Distance Crossing the Plate

Other Key Variables

- Bat Speed (Whiff & xwOBACON models)
- Batter Specific Preferences
  - Modeled using GAM
- 2 Strike/3 Ball Counts

The Attack Zone

Implemented By Statcast in 2019

Further Divides Hitting Zones	Swing Rate	Strike Rate
Heart of Zone:	72%	99%
○ Mistake Pitches		
Shadow Zone	52%	47%
○ Edge of Strike Zone		
○ 50/50 Strike/Ball		
Chase	22%	<1%
○ Area Where Pitchers Throw 2 Strike Pitches		
Waste	5%	0%
○ Non-Competitive Pitches		
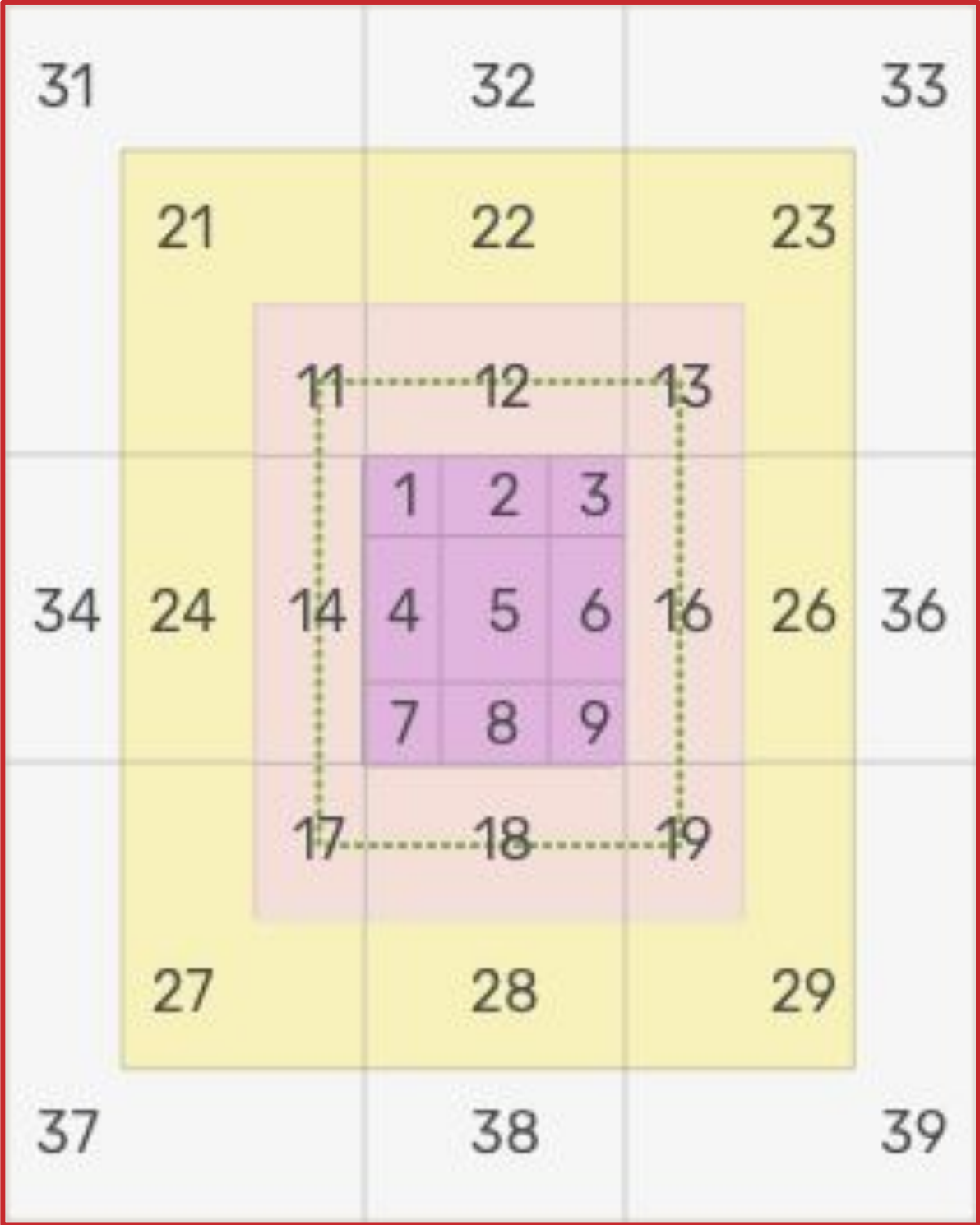
Building the Metric

SWING

ΔRE * (1 – Swing Prob) * Whiff Prob

xDamage – Player Season xwOBA

WEIGHTS

2 Strikes   Shadow: 0

3 Balls   Shadow: 1.2

NO SWING

ΔRE * Swing Prob * (1 – Whiff Prob)

Player Season xwOBA – xDamage

WEIGHTS

2 Strikes {
Shadow: 1.2
Heart: 1.5
FF in Heart: 2
}

3 Balls {
Shadow: 0.75
FF in Heart: 1.2
}

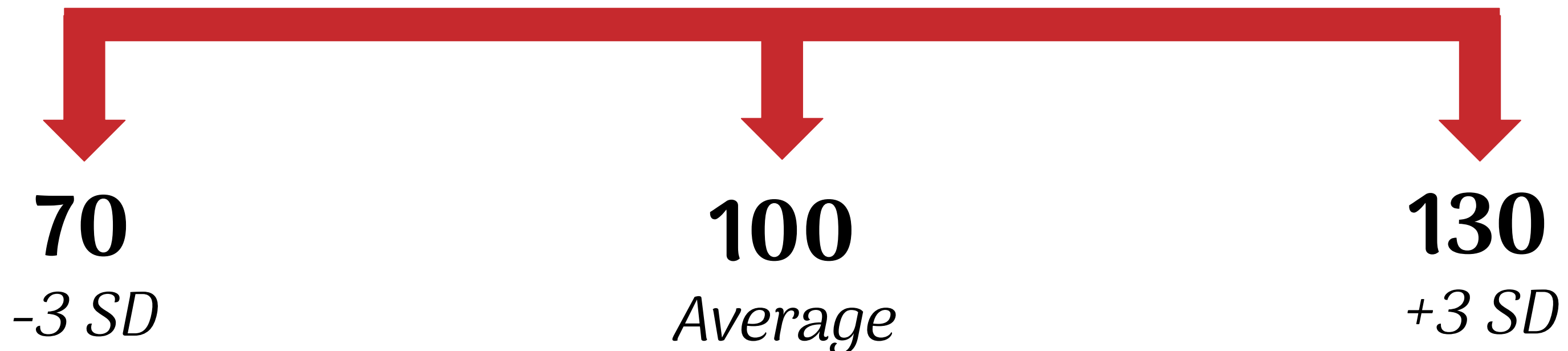** For Both Equations, Weights are Applied AFTER Calculations*
* 3-2 Counts are UNWEIGHTED
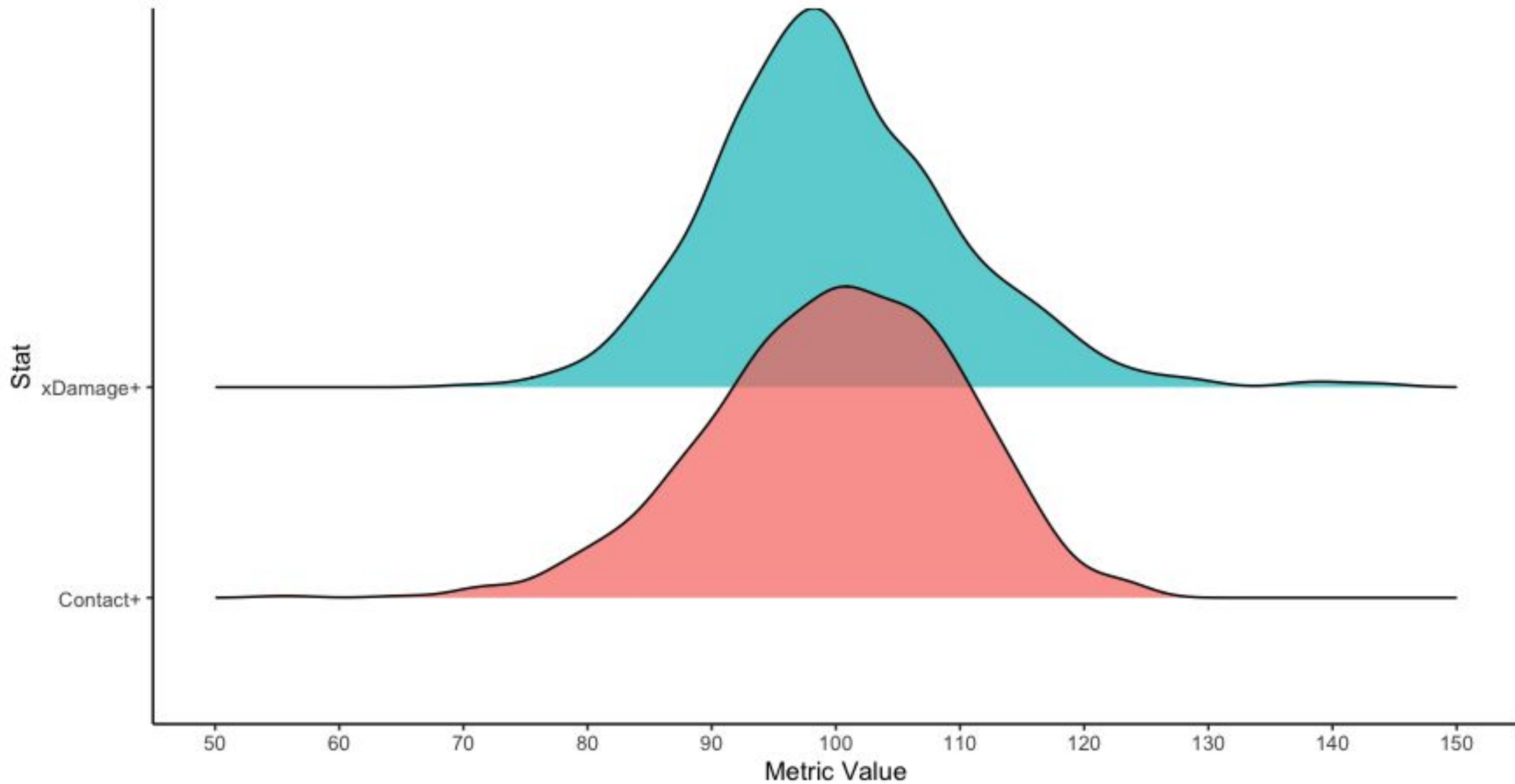
How the Metric Works

Once Each Statistic is Predicted:

1. Find Z-Scores of Contact & Damage Metrics

2. Creates 2 Unique Swing Decision Metrics:

   - *Contact+*
   - *xDamage+*

3. Convert to 100 point scale w/ 10 point SD

*these steps are on a per season basis

70
-3 SD

100
Average

130
+3 SD

Distribution Of Both xDamage+ & Contact+

Leaderboard

2024: Min. 150 PA
2025: Min. 100 PA

Top 10 Contact+

Batter	Season	Contact+
Gleyber Torres	2025	124
Mike Tauchman	2024	124
Taylor Walls	2025	123
Jeff McNeil	2025	123
Max Schuemann	2025	123
Kyle Tucker	2025	123
Luke Raley	2025	122
Max Muncy	2025	121
Edgar Quero	2025	121
Matt Thaiss	2025	120

Top 10 xDamage+

Batter	Season	xDamage+
Aaron Judge	2024	152
Juan Soto	2025	144
Aaron Judge	2025	142
Juan Soto	2024	139
Shohei Ohtani	2024	139
Kyle Tucker	2024	137
Brent Rooker	2025	129
Shohei Ohtani	2025	128
Kyle Tucker	2025	128
Pavin Smith	2024	128

Leaderboard

2024: Min. 150 PA
2025: Min. 100 PA

Bottom 10 Contact+

Batter	Season	Contact+
Denzel Clarke	2025	56
Javier Báez	2024	65
Javier Báez	2025	70
Josh Jung	2024	71
Jose Iglesias	2025	71
Noelvi Marte	2024	72
Lenyn Sosa	2025	72
Jhonkensy Noel	2024	73
Oneil Cruz	2025	75
Jhonkensy Noel	2025	76

Bottom 10 xDamage+

Batter	Season	xDamage+
Jonah Bride	2025	70
Brandon Drury	2024	73
Jose Herrera	2025	76
Alan Roden	2025	77
Hunter Renfroe	2025	78
Ben Rortvedt	2025	78
Ke'Bryan Hayes	2024	78
Jordan Walker	2025	79
Lane Thomas	2025	79
Jac Caglianone	2025	80

Reliability

	2024-25 wOBA	2024-25 xwOBA	2024-25 BB%-K%	2024-25 Chase%
2024-25 Contact+	0.142	0.142	0.520	-0.614
2024-25 xDamage+	0.609	0.635	0.034	-0.031

	2025 wOBA	2025 xwOBA	2025 BB%-K%	2025 Chase%
2024 Contact+	0.053	0.053	0.363	-0.482
2024 xDamage+	0.495	0.522	-0.057	0.042

Reliability

Contact+ Stickiness — 2025 Contact+ vs 2024 Contact+, r = 0.668

Contact+ Cronbach Alpha (2024) — Cronbach's Alpha vs Sample Size (Pitches); 1350 Pitches (Roughly 340 PA)
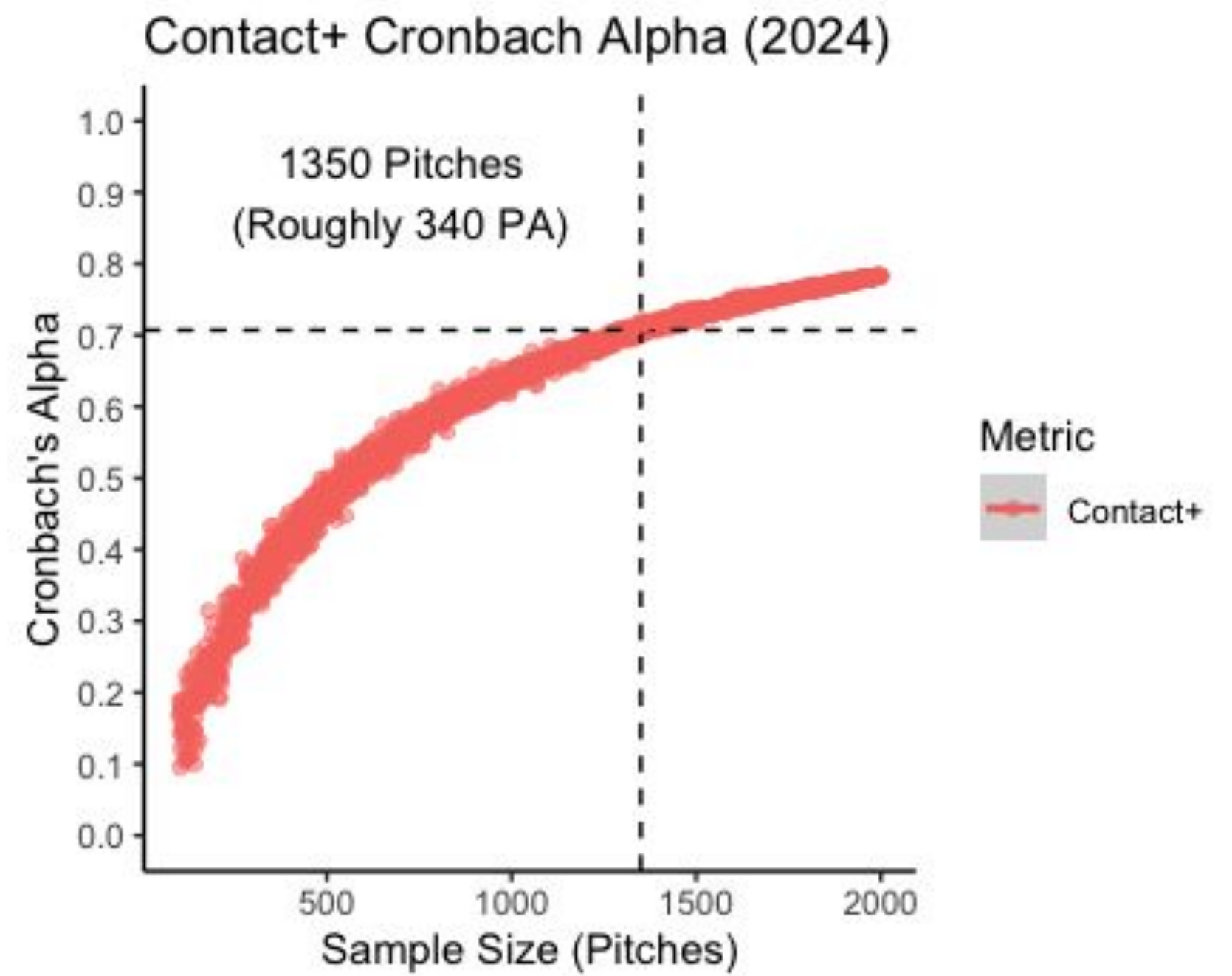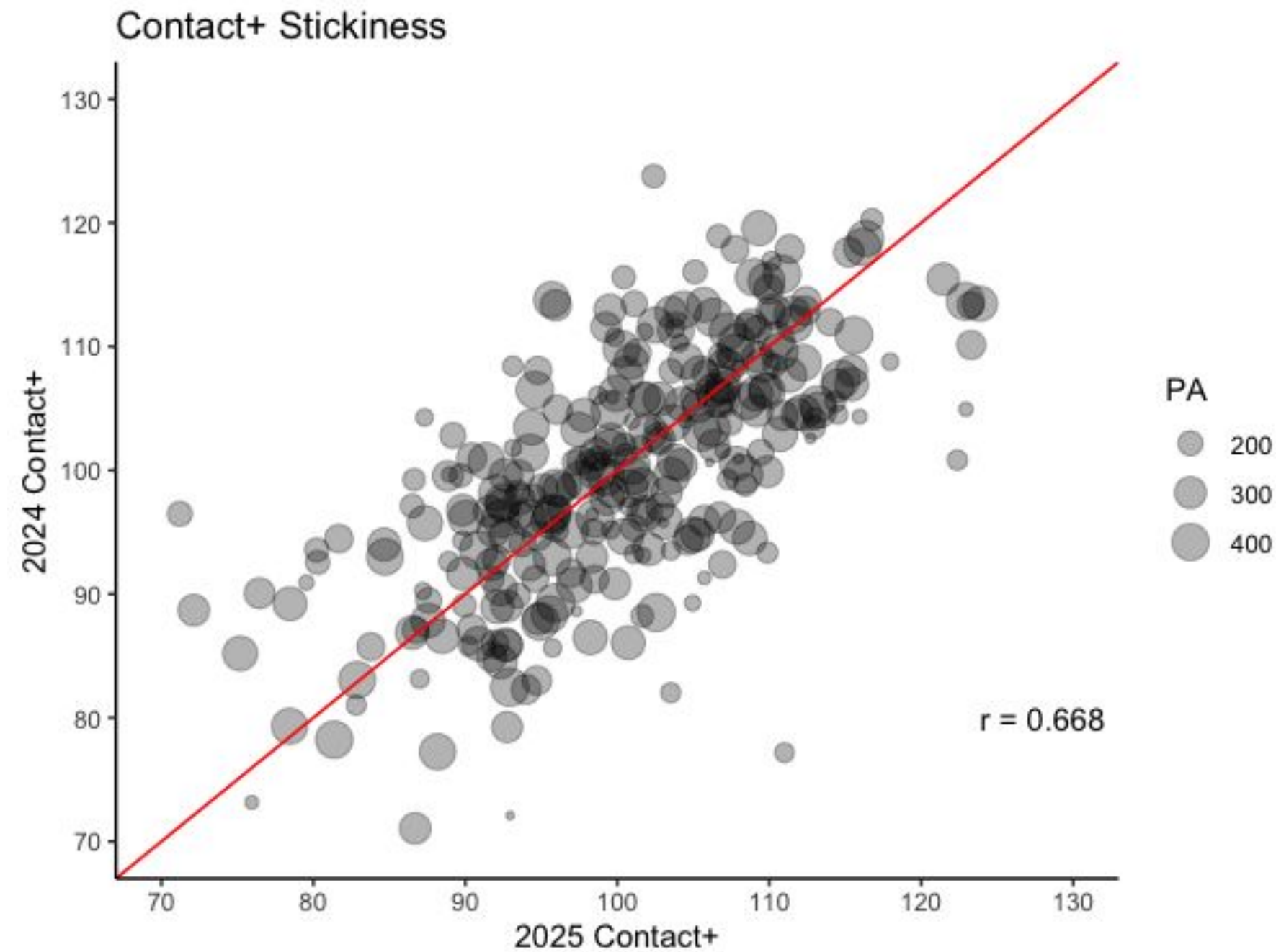
Reliability

Reliability

2024 xDamage+ vs 2025 wOBA

r = 0.495

2024 wOBA vs 2025 wOBA

r = 0.299

Reliability

2024 xDamage+ vs 2025 wOBA — r = 0.495

2024 xwOBA vs 2025 wOBA — r = 0.397
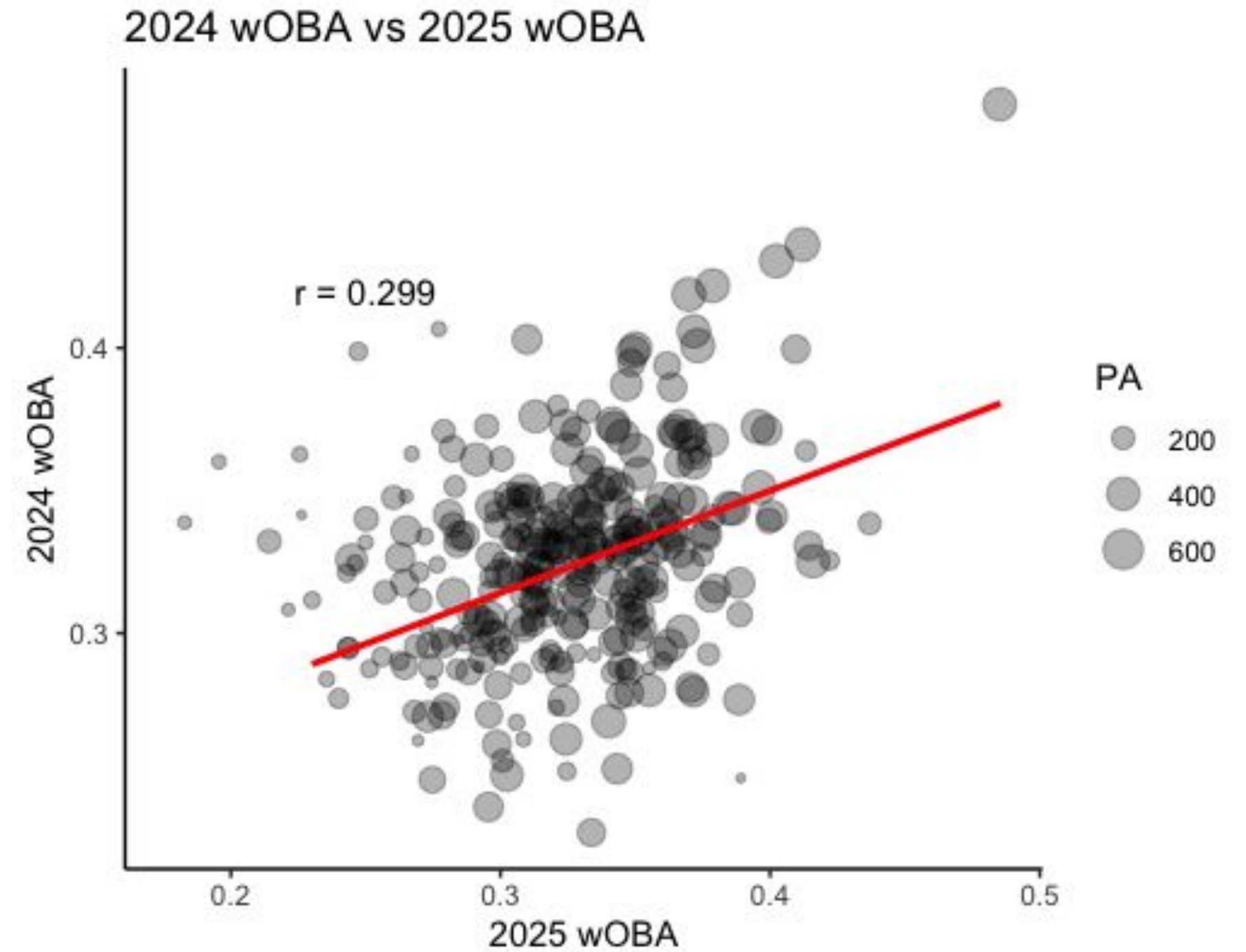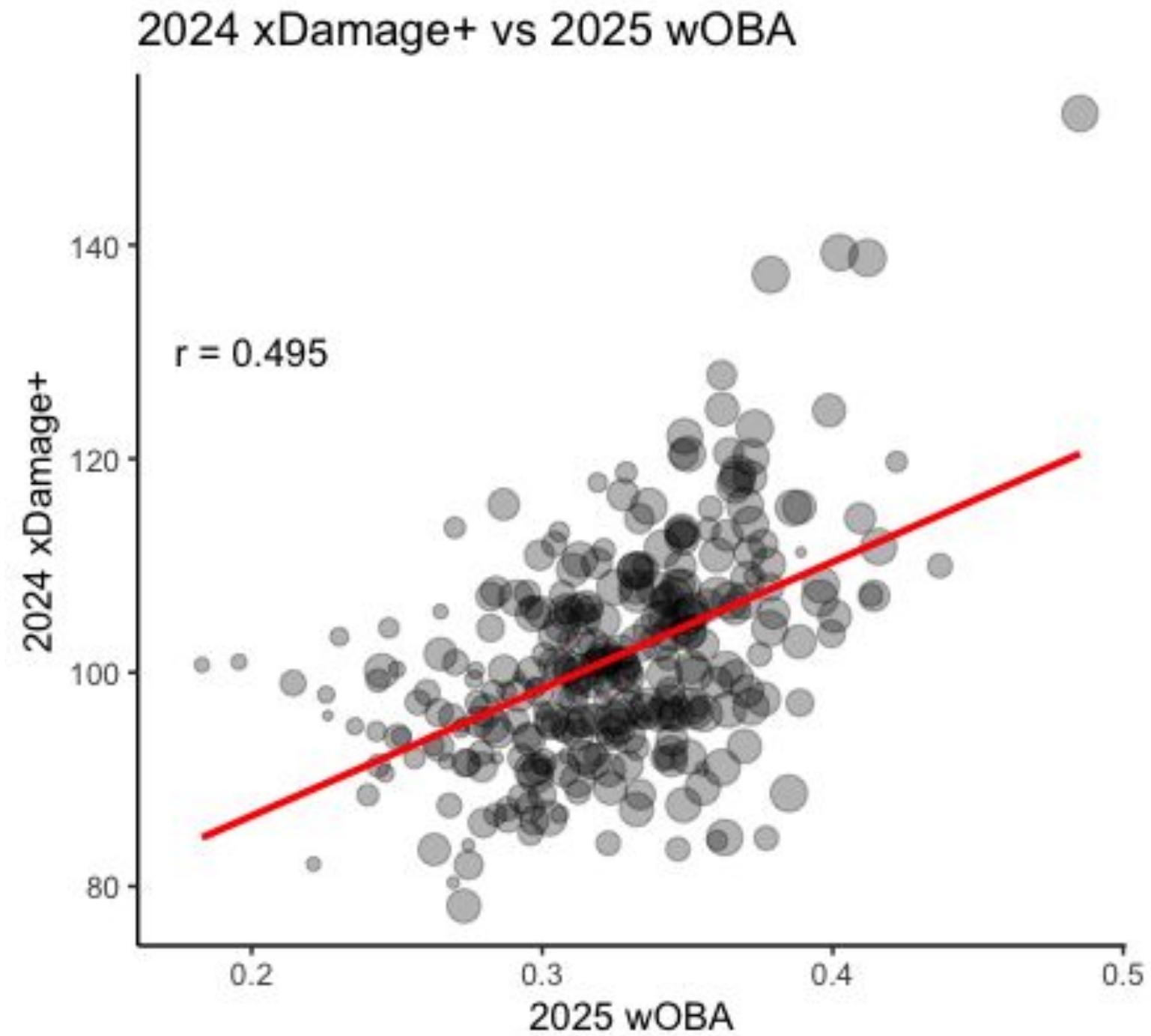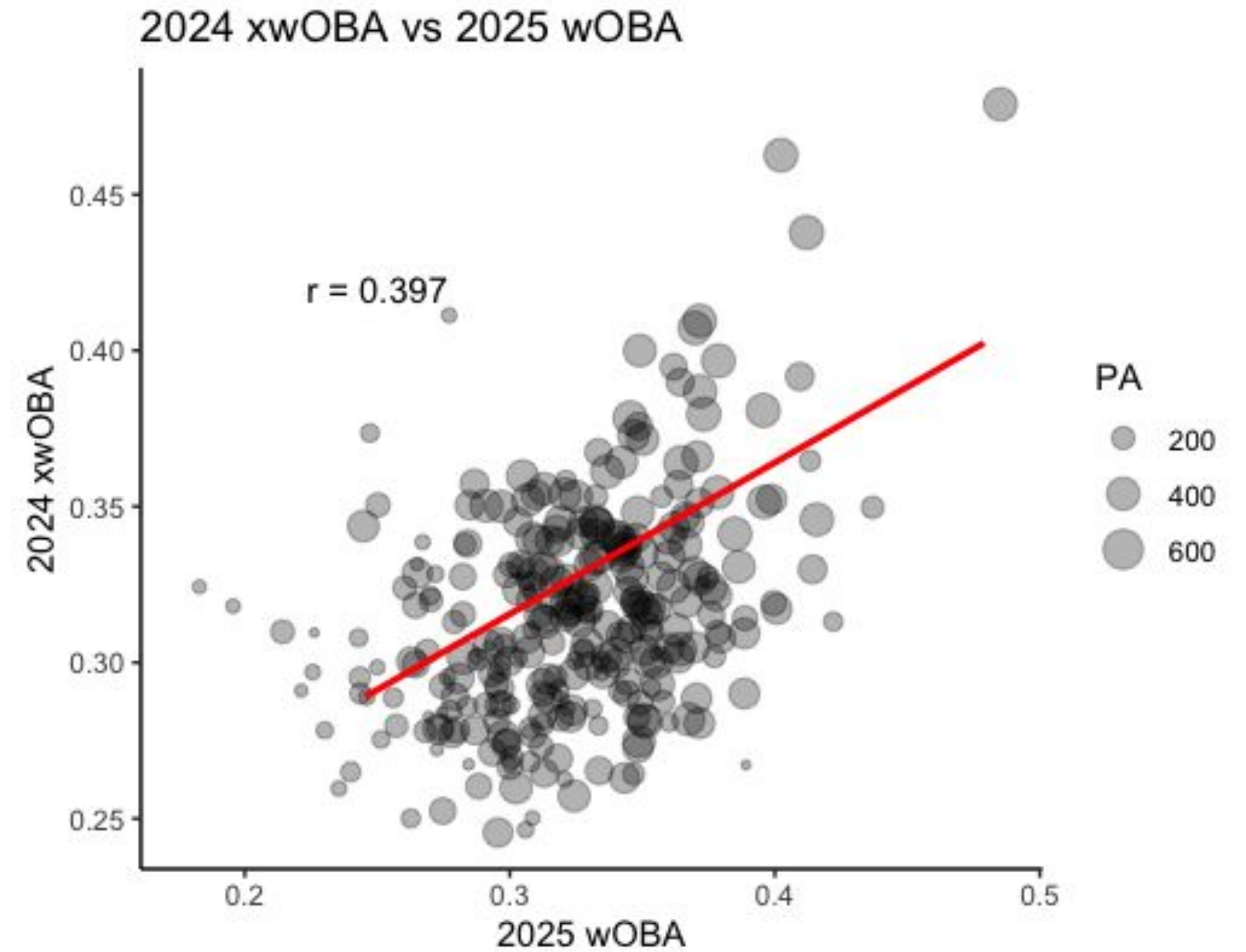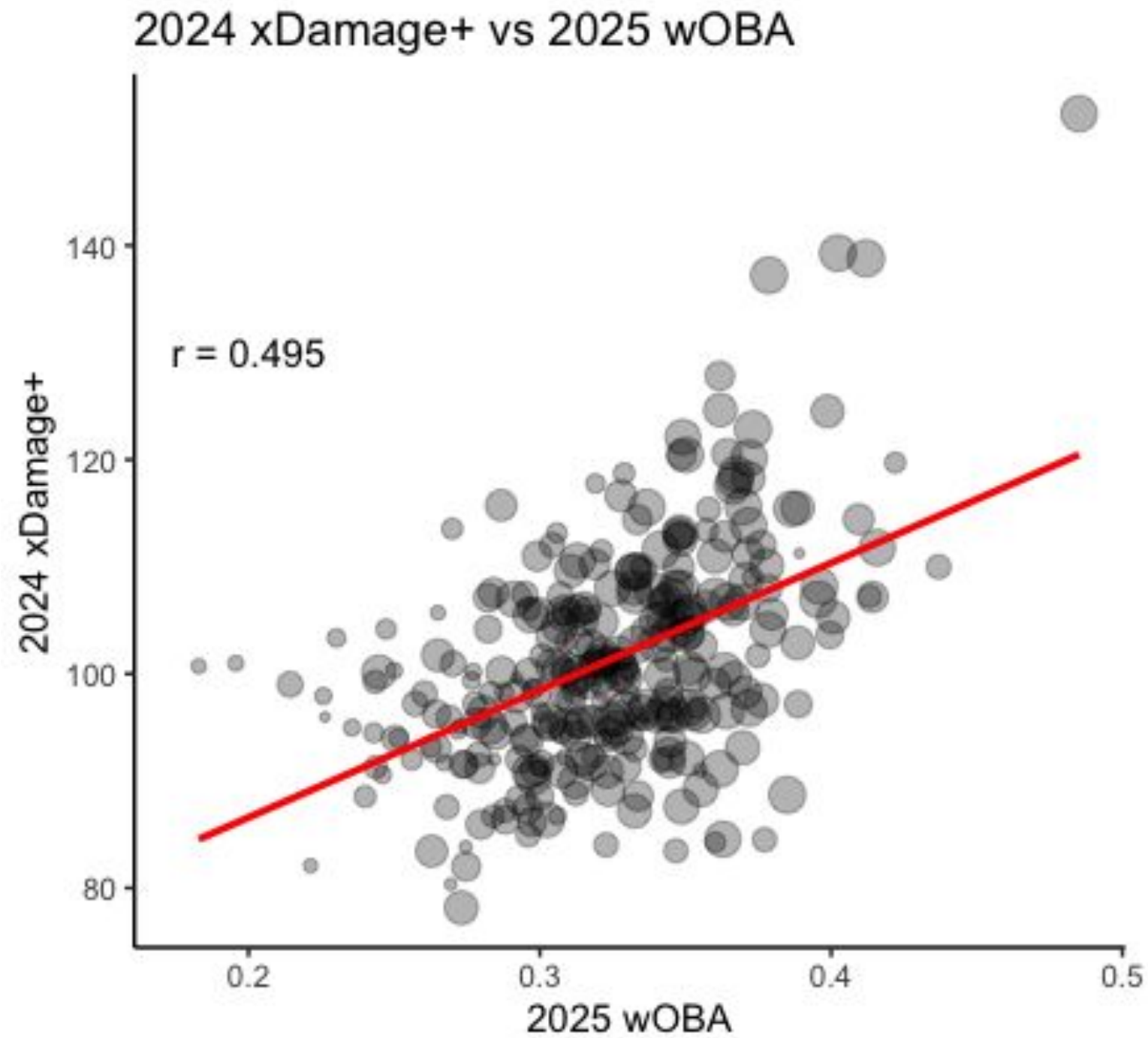
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