WHIFF FACTOR

Modeling Park Effects of
Whiff Rates in MLB and AAA

Gabe Appelbaum

"For some reason I couldn't figure it out. **I couldn't feel good at the plate at home…** I talk to a lot of players around the league, and they **feel the same thing when they go to Seattle**"

- TEOSCAR HERNANDEZ TO THE SEATTLE TIMES, 2024

(Lindsey Wasson / Associated Press)

INTRODUCTION

Park Factors: which outcomes are more/less frequent at each park?

Parks affect batter-pitcher interaction, not just batted balls

Statcast measures parks' effects on **K** and **BB** rate

FACTOR	YEAR	▼	SEASON	2024	▼	BAT SIDE	BOTH	▼	CONDITION	ALL	▼	ROLLING YEARS	3	▼	PARKS	MLB	▼	Update

Rk.	Team	Venue	Year	Park Factor	wOBACon	xwOBACon	BACON	xBACON	HardHit	R	OBP	H	1B	2B	3B	HR	BB	SO	PA
1	Mariners	T-Mobile Park	2022-2024	91	94	98	94	98	96	83	92	90	91	85	59	96	95	115	55,886
2	Brewers	American Family Field	2022-2024	97	100	101	97	100	97	94	96	94	91	87	93	114	106	112	57,190
3	Braves	Truist Park	2022-2024	100	104	105	104	103	105	100	100	102	103	95	87	105	98	109	56,162
4	Rays	Tropicana Field	2022-2024	96	98	98	98	98	96	92	96	96	94	96	114	98	95	108	55,802
5	Angels	Angel Stadium	2022-2024	100	102	101	100	100	98	100	100	98	98	90	102	112	103	106	55,854

Baseball Savant

PROBLEMS

PROBLEMS

Two major flaws with the current systems:

01 Measuring on the at-bat level instead of the pitch level **doesn't properly account for the quality of the pitches**

02 Treating individual stadiums the same across day/night, roof open/closed **ignores the effects of different light conditions**

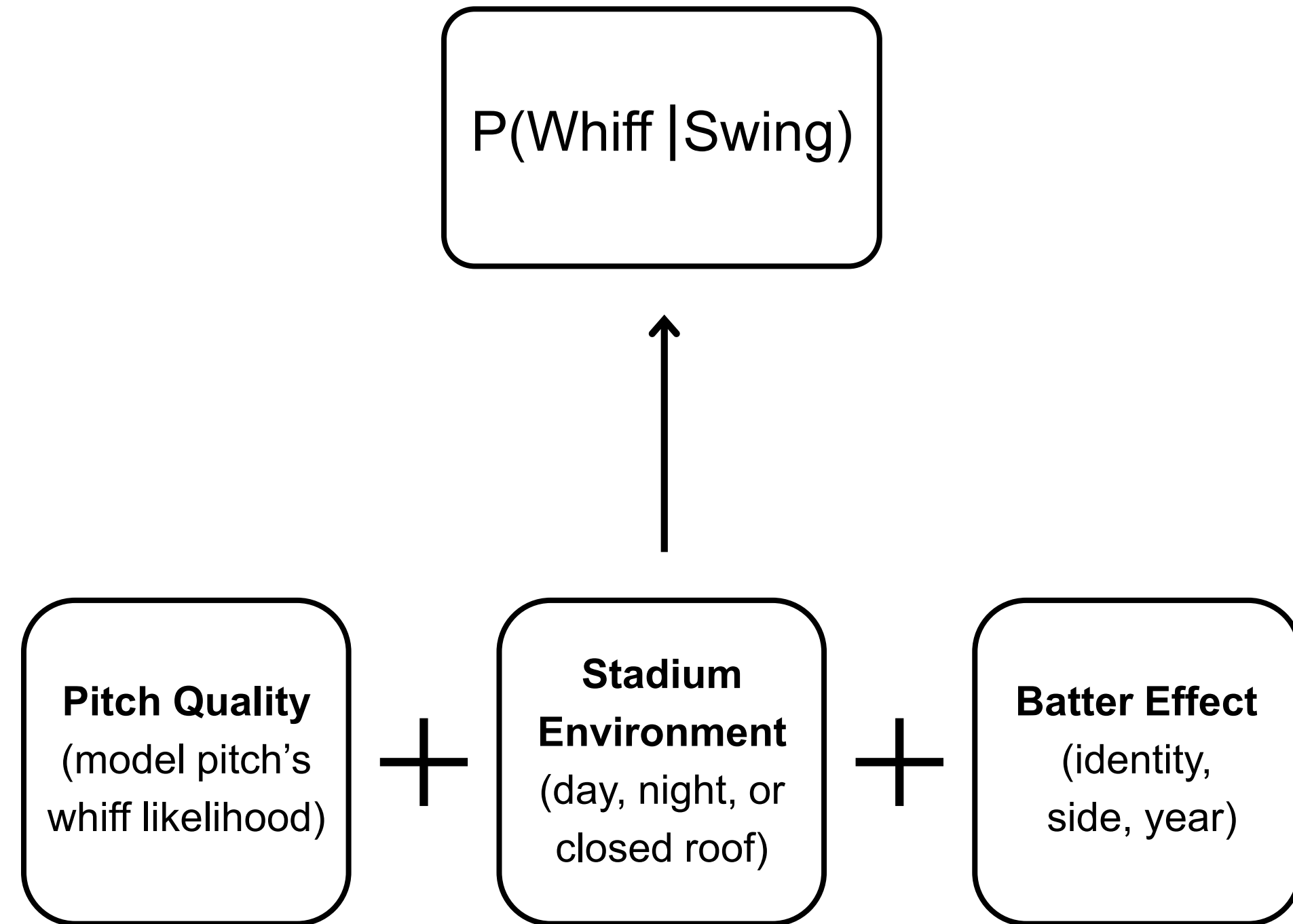In addition, there is a lack of public research on these park effects **below MLB**

Approach

METHODS

- **Data:** Public data from MLB. Swings in full-time MLB/AAA stadiums, 2022-24 regular seasons

- Fit a catboost model for pitch quality (whiff likelihood)

- **Whiff Factor model:** logistic mixed effects model

- P(whiff | swing) ~
  - pitch quality +
  - batter effect +
  - **stadium-environment effect**

RESULTS

TOP 5 AND BOTTOM 5 MLB WHIFF FACTORS

Top 5 MLB Whiff Factors

Org	Stadium - Environment	Whiff Factor
	Angel Stadium - Day	114
	T-Mobile Park - Day	113
	Truist Park - Day	113
	Coors Field - Day	108
	Dodger Stadium - Day	108

Bottom 5 MLB Whiff Factors

Org	Stadium - Environment	Whiff Factor
	Kauffman Stadium - Night	87
	loanDepot park - Roof Closed	91
	Nationals Park - Night	91
	Busch Stadium - Night	92
	Fenway Park - Day	92

TOP 5 AND BOTTOM 5 AAA WHIFF FACTORS

Top 5 AAA Whiff Factors

Org	Location	Stadium - Environment	Whiff Factor
Rays	Durham, N.C.	Durham Bulls Athletic Park - Night	116
D	Toledo, OH	Fifth Third Field - Night	113
Giants	Sacremento, CA	Sutter Health Park - Night	113
Miami	Jacksonville, FL	121 Financial Ballpark - Night	109
D	Toledo, OH	Fifth Third Field - Day	109

Bottom 5 AAA Whiff Factors

Org	Location	Stadium - Environment	Whiff Factor
Mariners	Tacoma, WA	Cheney Stadium - Night	86
Cardinals	Memphis, TN	AutoZone Park - Night	87
Cardinals	Memphis, TN	AutoZone Park - Day	89
Mariners	Tacoma, WA	Cheney Stadium - Day	90
Braves	Lawrenceville, GA	Coolray Field - Day	92

DAY VS. NIGHT

Is MLB Whiff Factor higher or lower during the day?
Stadiums sorted by day time whiff factor
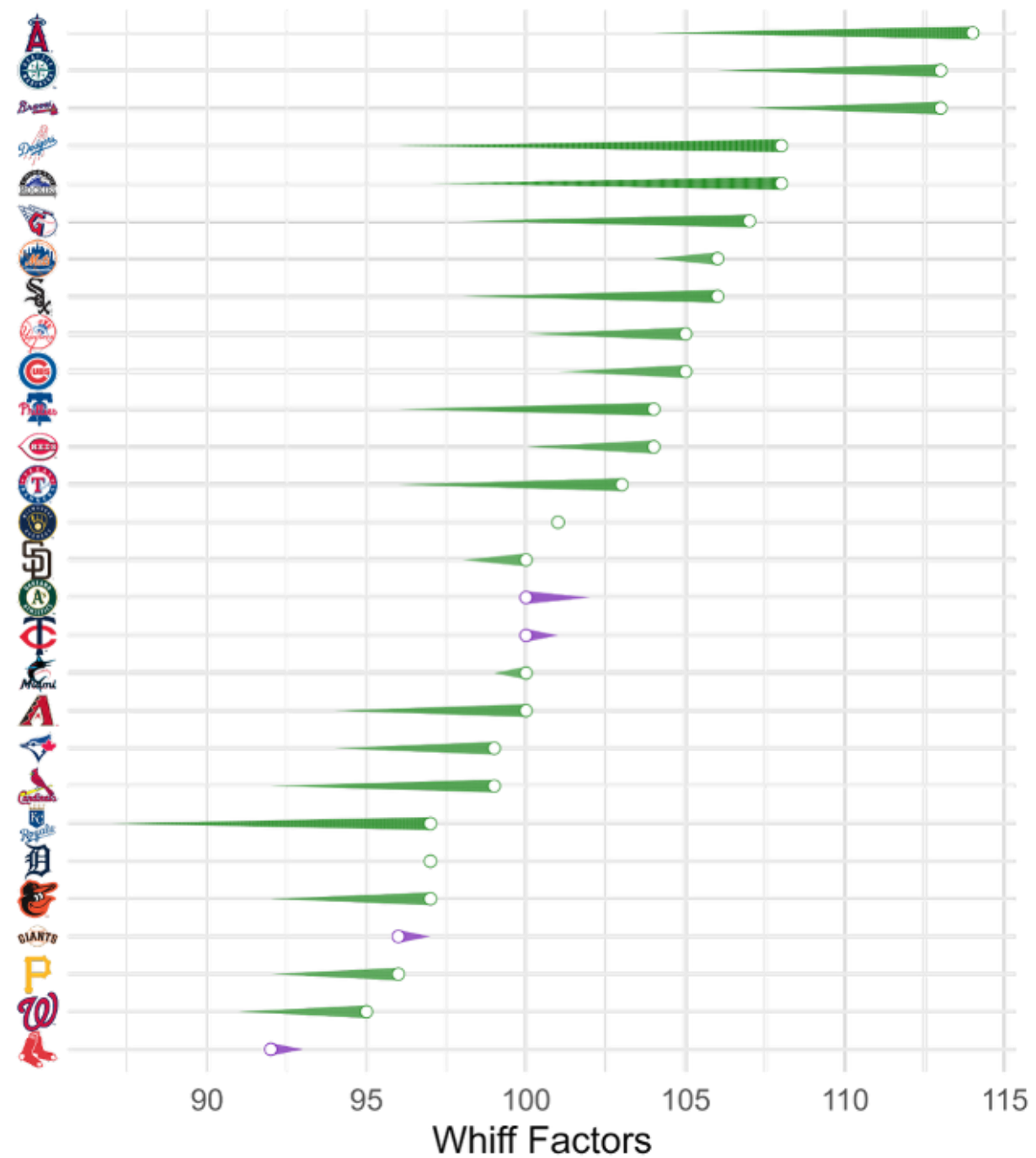
MLB: 4.7 points **more whiffs** during day

Is AAA Whiff Factor higher or lower during the day?
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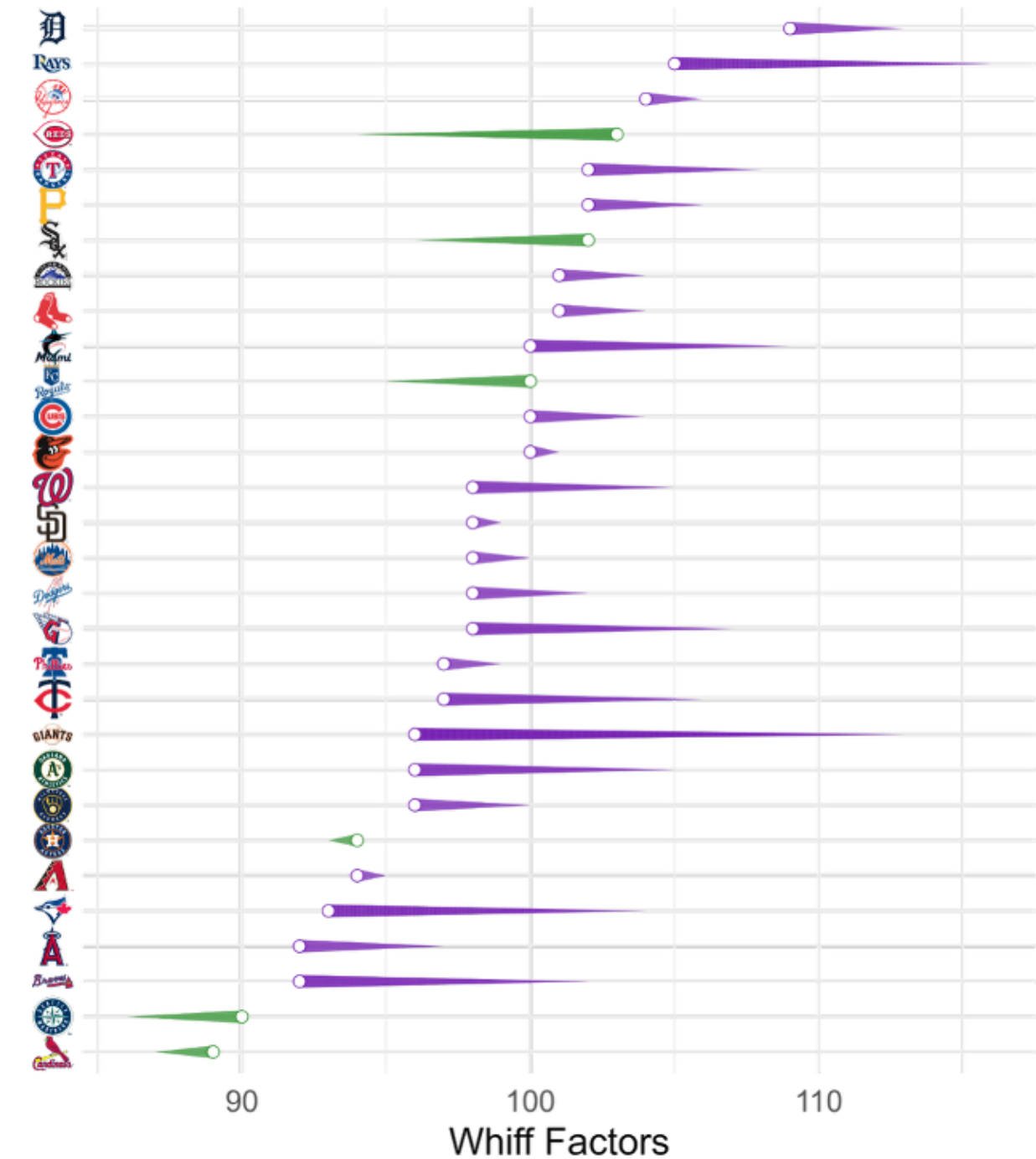
AAA: 3.7 points **less whiffs** during day

EXAMPLES: MLB STADIUMS

Werner Kunz

Google Maps

thisgreatgame.com

SEATTLE: T-MOBILE PARK

Roof open, day: **113**

Roof open, night: **106**

Roof closed: **107**

- Seattle's batter's eye gives **confusing depth information:**

    - The batter's eye is **slanted, not straight-on** to the hitter

    - It's an **extremely dark black,** which could further limit batters' perception

Humans are bad at Depth Perception
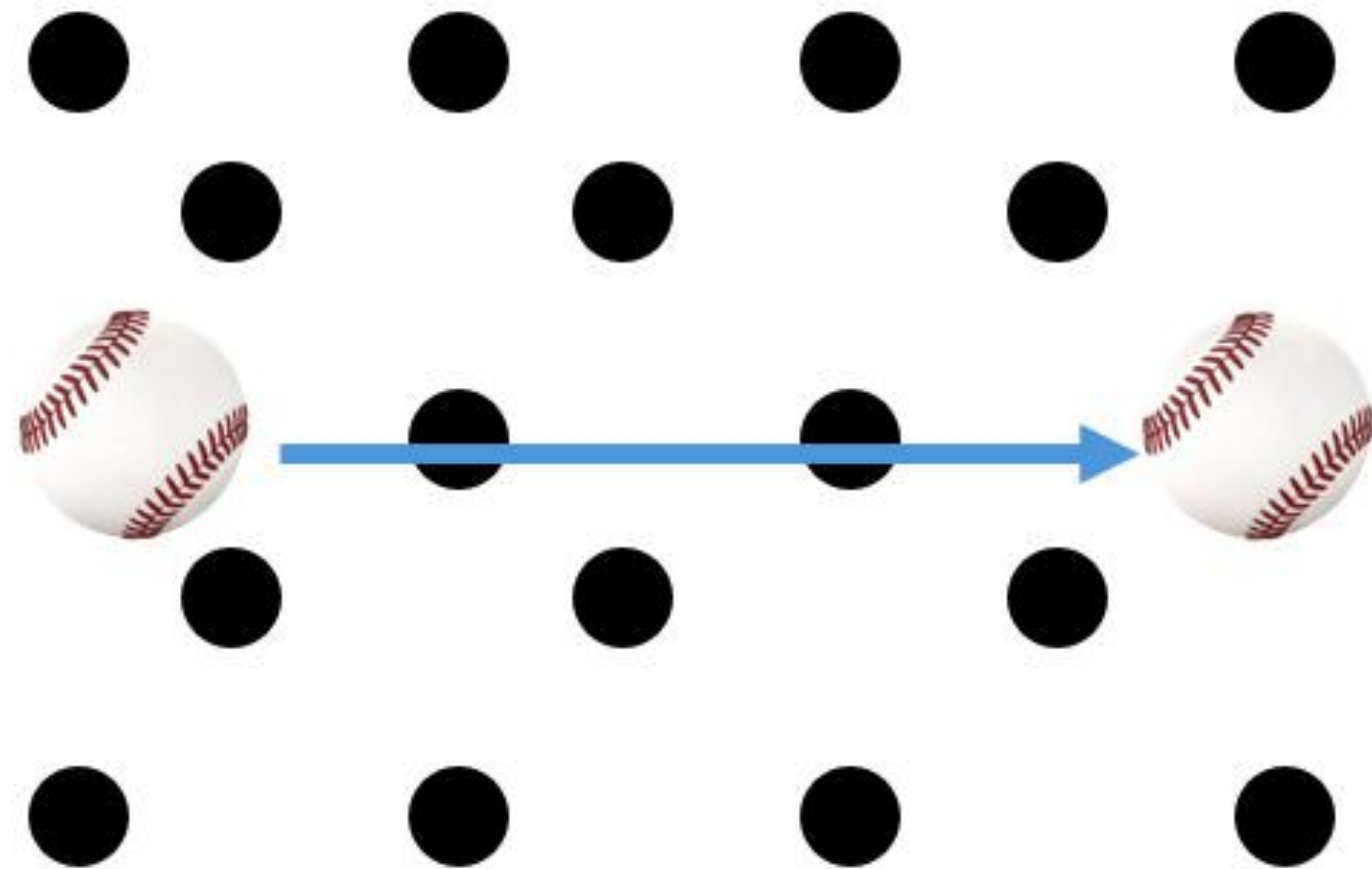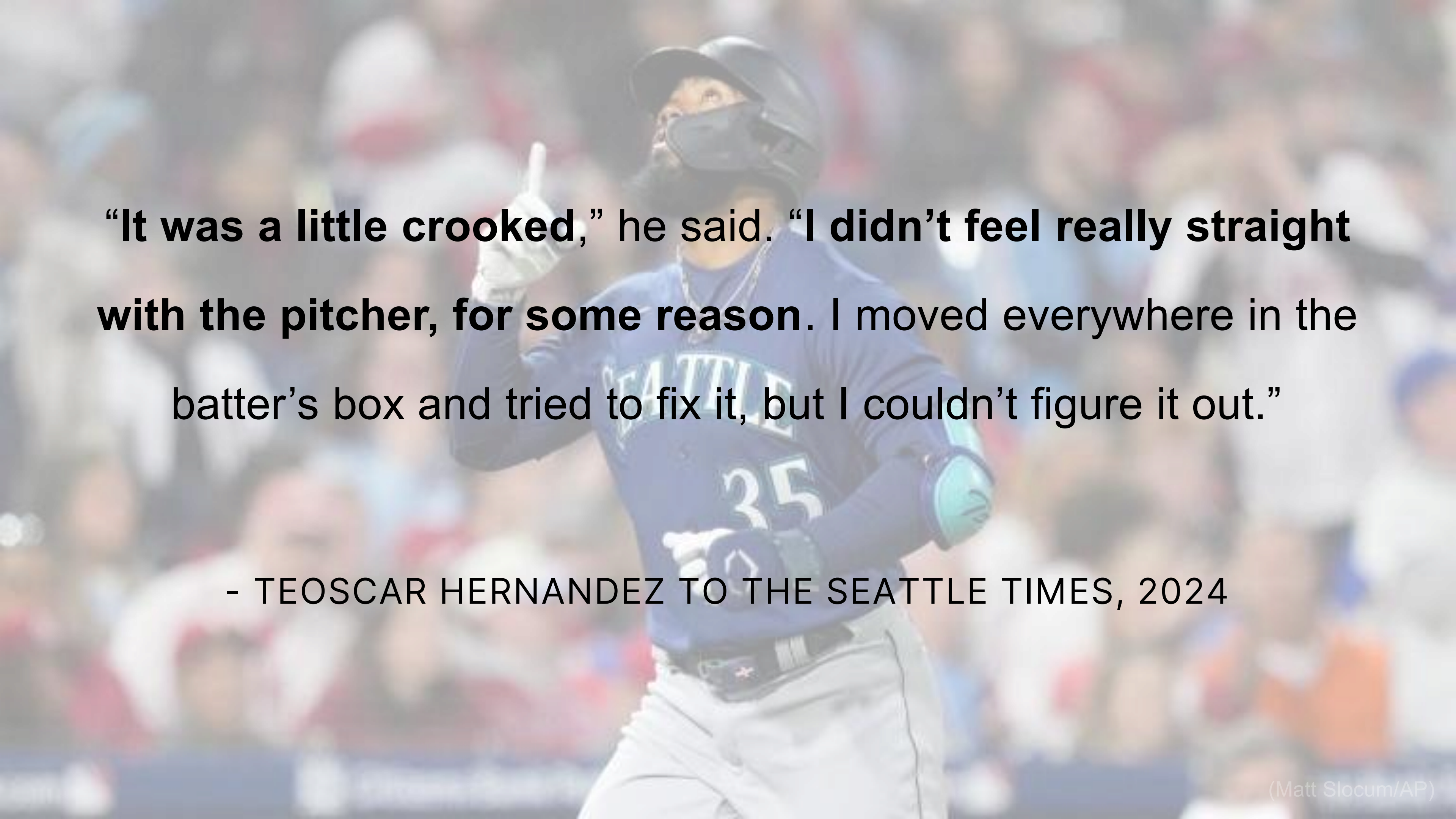
Parallel batter's eye
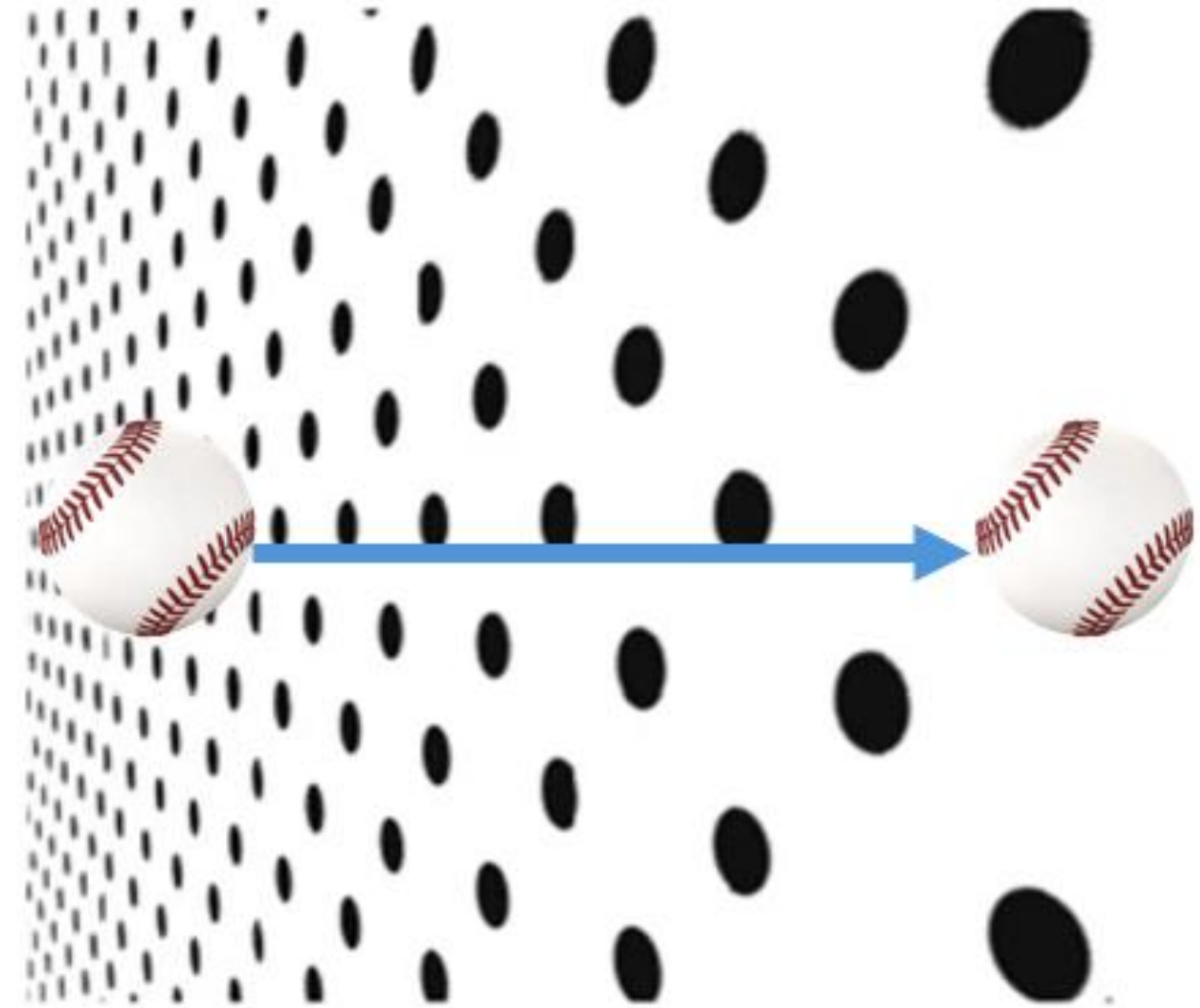
Slanted batter's eye

Rob Gray, Perception Action

"**It was a little crooked**," he said. "**I didn't feel really straight with the pitcher, for some reason**. I moved everywhere in the batter's box and tried to fix it, but I couldn't figure it out."

- TEOSCAR HERNANDEZ TO THE SEATTLE TIMES, 2024

LA ANGELS: ANGELS STADIUM

Day: **114**

Night: **104**

- Batters here suffer from:

    - **Varying slants:** bushes, lawn, and rocks all

      have different slants

    - **Varying colors,** including light brown rocks

      (pretty close to a baseball color!)

        - The rocks can also reflect sunlight during

          day games

The Hardball Times

KANSAS CITY: KAUFFMAN STADIUM

Day: **97**

Night: **87**

- Flat, plain green surface
- Perpendicular to the batter

What makes a challenging Batter's Eye?

"A batter's eye is most effective when it offers a uniform, uncluttered background that allows hitters to clearly track the ball from the pitcher's hand. **Anything that breaks that uniformity—such as patches of sunlight and shadow, busy patterns from trees or buildings, or unusual angles where the backdrop changes height—can make picking up the ball more difficult**… On the other hand, a clean, consistent background at the right depth can help the hitter lock in and track the ball with minimal interference"

Dr. Sean Teebagy, Ophthalmologist UMass Medical School

Big Issues in Batter's Eyes

SLANTS	TEXTURES	COLORS
Angled surfaces = changing depths as the hitter tracks the pitch	Nature/foliage can make it hard to pick up the baseball	Light-colored rocks make the ball blend in. Super-deep blacks obscure depth information

COLORADO: COORS FIELD

Day Whiff Factor: **108**

Night Whiff Factor: **97**

Savant K Factor: **89**

- Coors has a **high Whiff Factor** but a **low K Factor**
  - Coors **decreases pitch quality** leading to a decrease in K rate
  - But the Coors **batters' eye is very challenging**

Do-Hyoung Park, @dohyoungpark on X

CONCLUSION

- This project was able to quantify a sense hitters already have

- Whiff rates are used heavily in scouting and evaluating

Questions?

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CREDITS

- Articles/quotes
  - Teoscar Hernandez's struggles in Seattle remain a mystery: 'I couldn't feel good', by Adam Jude, Seattle Times (7/15/2024)
  - Is the batter's eye in Seattle an Ames room? A perceptual analysis of the challenge of hitting in T-Mobile park, by Rob Gray, Perception Action (2/1/2025)
  - Dr. Sean Teebagy, Umass Medical School

- Code/visualizations
  - Josh Hejka, Driveline Baseball
  - Chris, Bless Your Chart
  - Owen Phillips, The F5

- Special thanks
  - Max Feinleib, Aidan Beilke, David Gerth, John Asel, Josh Witmer, Down on the farm