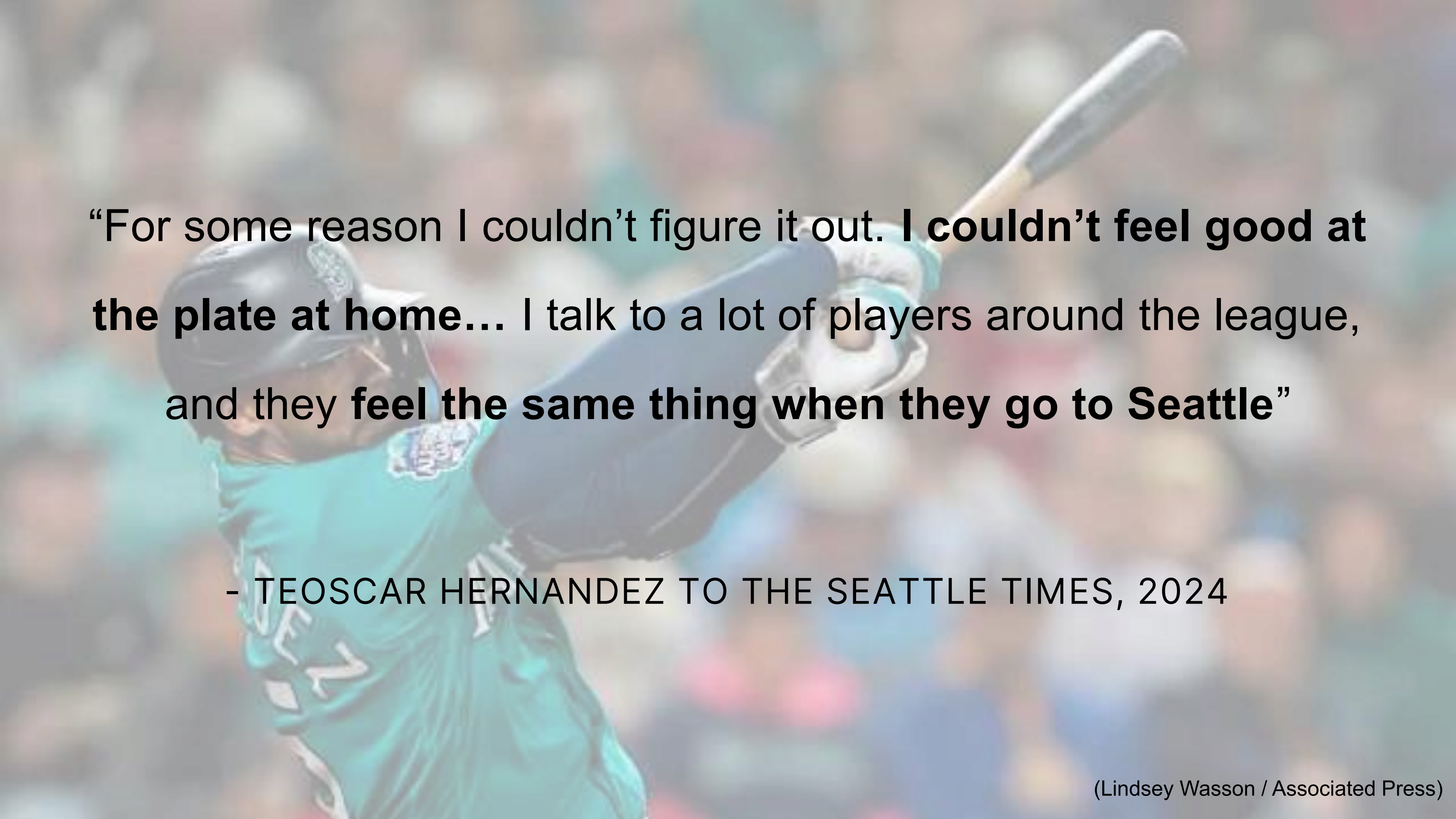


WHIFF FACTOR

Modeling Park Effects of
Whiff Rates in MLB and AAA

Gabe Appelbaum



A baseball player in a teal uniform is captured mid-swing, holding a wooden bat. The background is a blurred crowd of spectators in a stadium.

“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

Three white baseballs with red stitching are positioned around the text. One is at the top center, one is at the bottom left, and one is at the bottom right.

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**

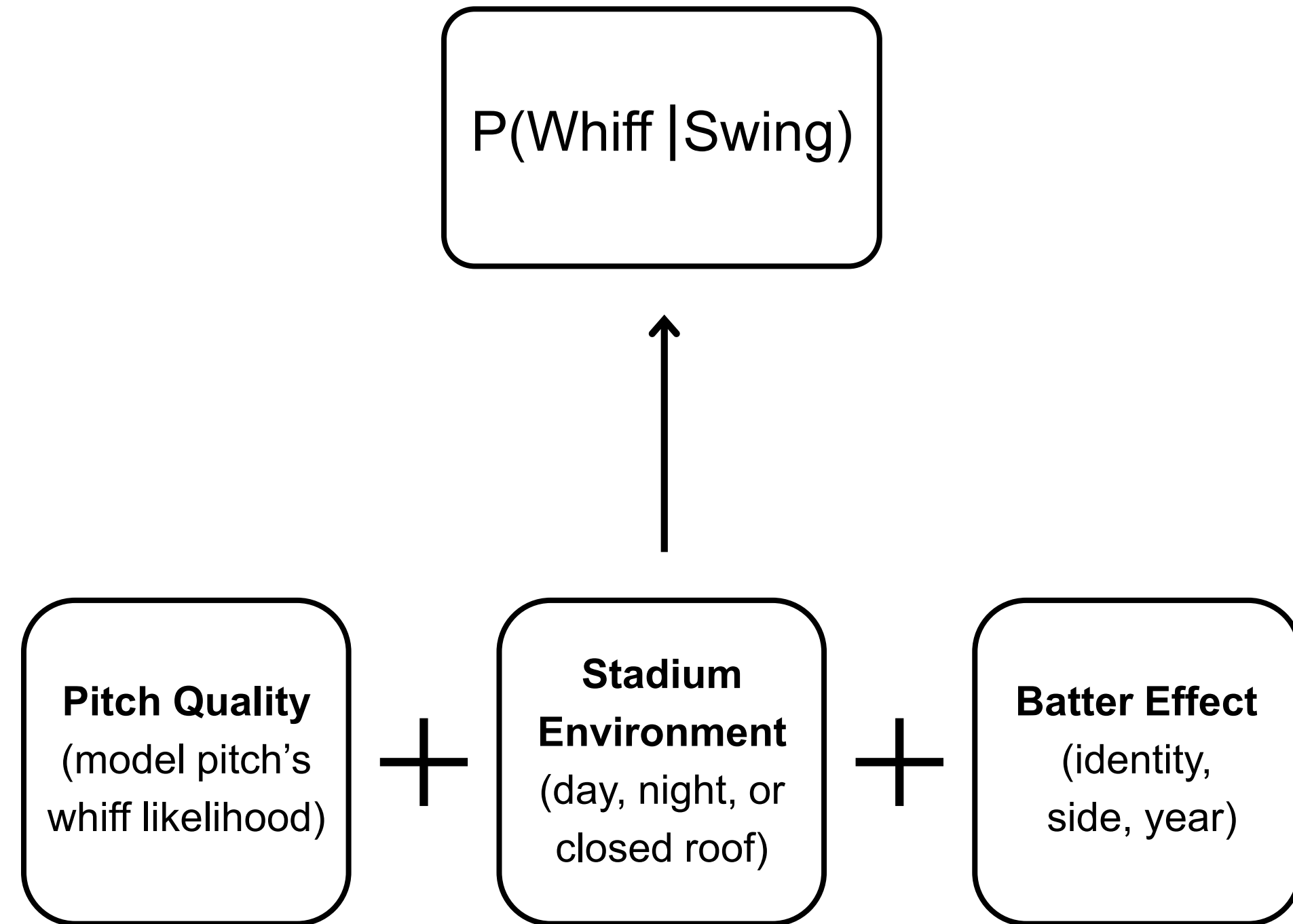


An aerial, high-angle view of a baseball stadium at night. The field is illuminated, showing the green grass and brown dirt base paths. A large, dense crowd of spectators fills the stands, which are visible on the left side of the frame. The word "Approach" is overlaid in large, white, bold letters across the center of the field.


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
- $P(\text{whiff} \mid \text{swing}) \sim$
 - pitch quality +
 - batter effect +
 - **stadium-environment effect**



RESULTS

A photograph of a baseball player in a batting cage. The player is wearing a blue jersey, white pants, and a yellow helmet, captured in the middle of a swing. The view is through the dark, curved protective netting of the cage. In the background, a baseball field is visible with other players in red and white uniforms. A scoreboard is visible in the distance. The word "RESULTS" is overlaid in large, white, bold capital letters in the center of the image.

TOP 5 AND BOTTOM 5 MLB WHIFF FACTORS

Top 5 MLB Whiff Factors

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

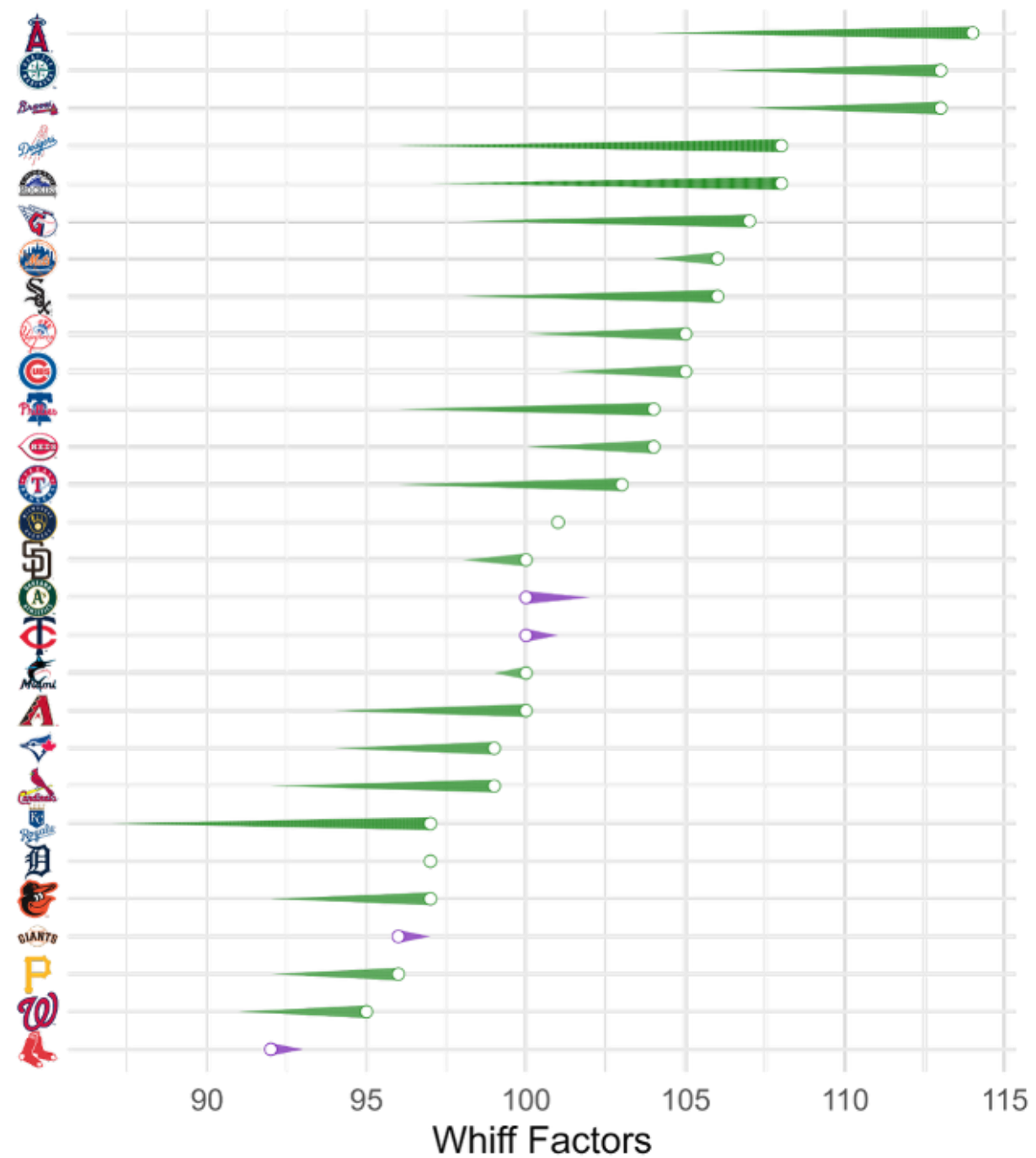
Bottom 5 AAA Whiff Factors

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

DAY VS. NIGHT

Is MLB Whiff Factor **higher** or **lower** during the day?

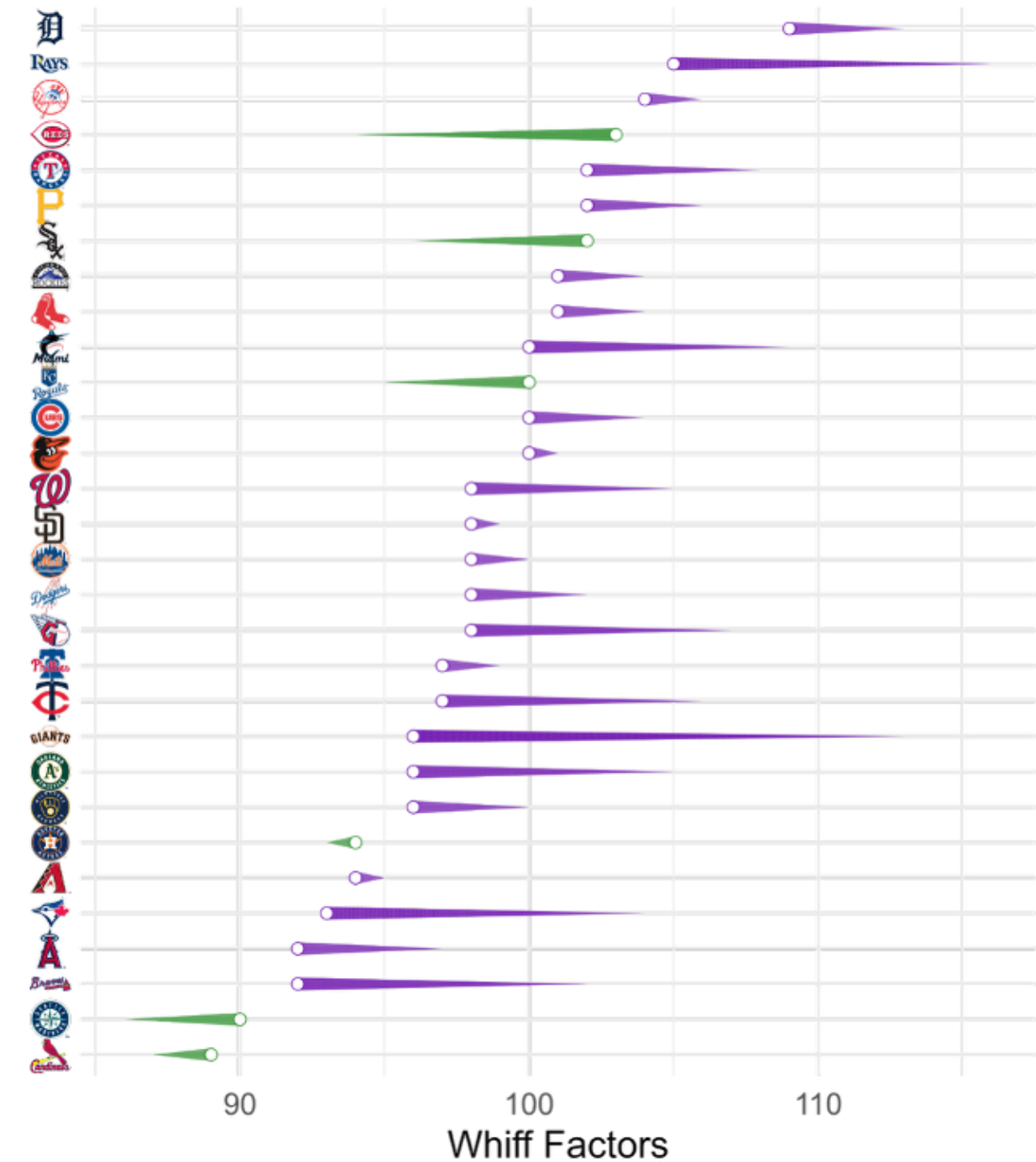
Stadiums sorted by day time whiff factor



MLB: 4.7 points **more whiffs** during day

Is AAA Whiff Factor **higher** or **lower** during the day?

Stadiums sorted by day time whiff factor



AAA: 3.7 points **less whiffs** during day

EXAMPLES: MLB STADIUMS

Google Maps



SEATTLE: T-MOBILE PARK

Roof open, day: **113**

Roof open, night: **106**

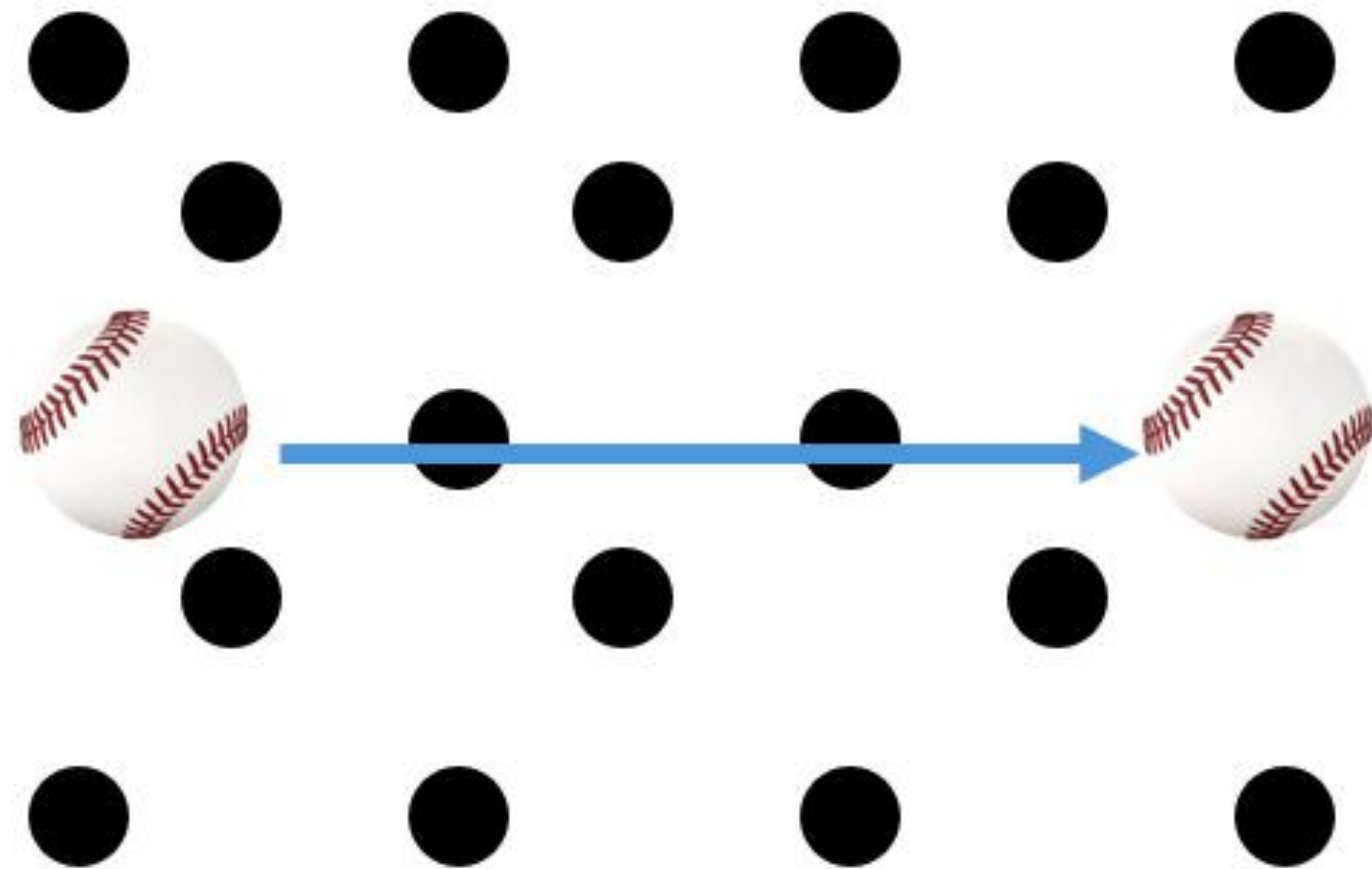
Roof closed: **107**

- 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

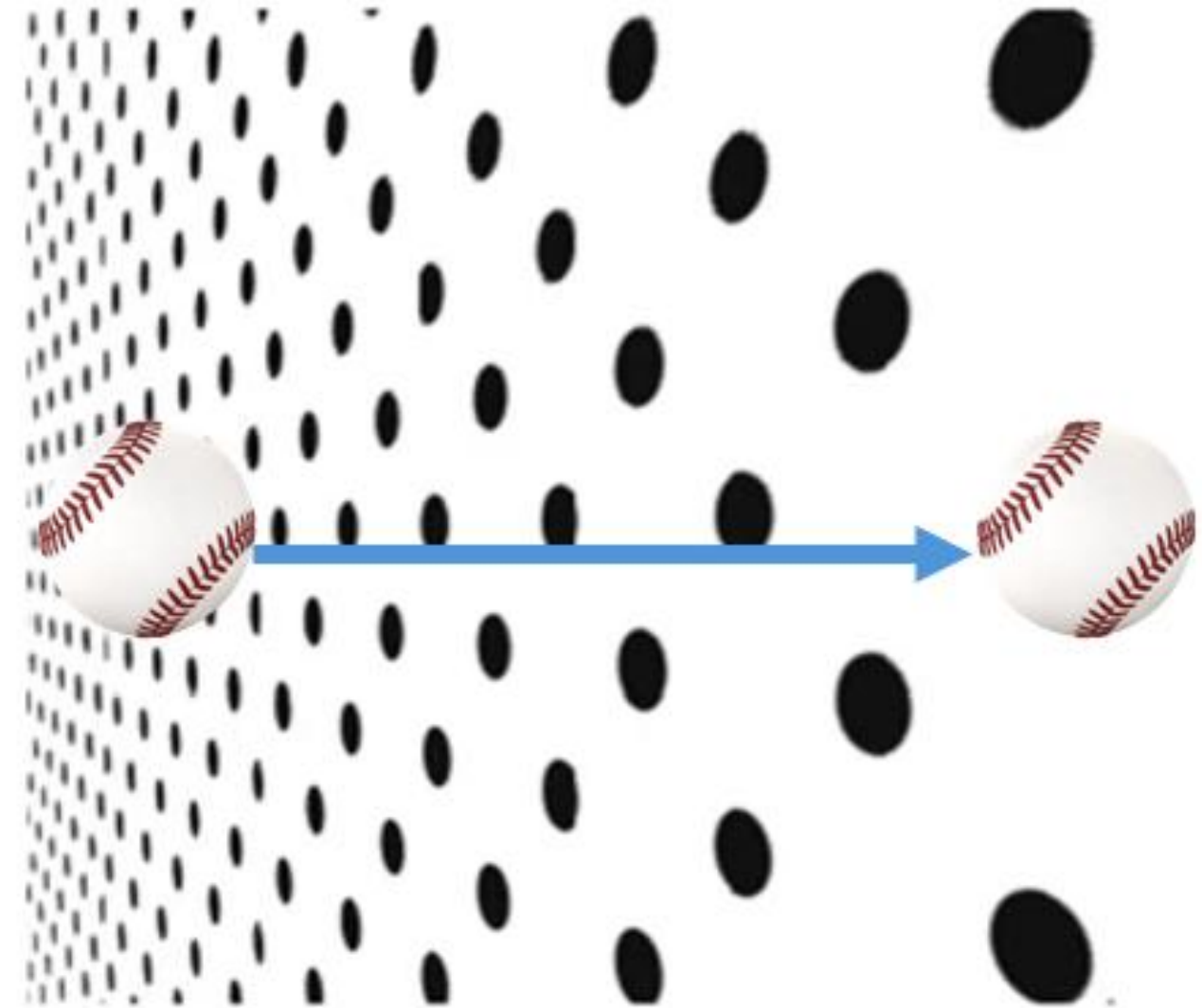


thisgreatgame.com

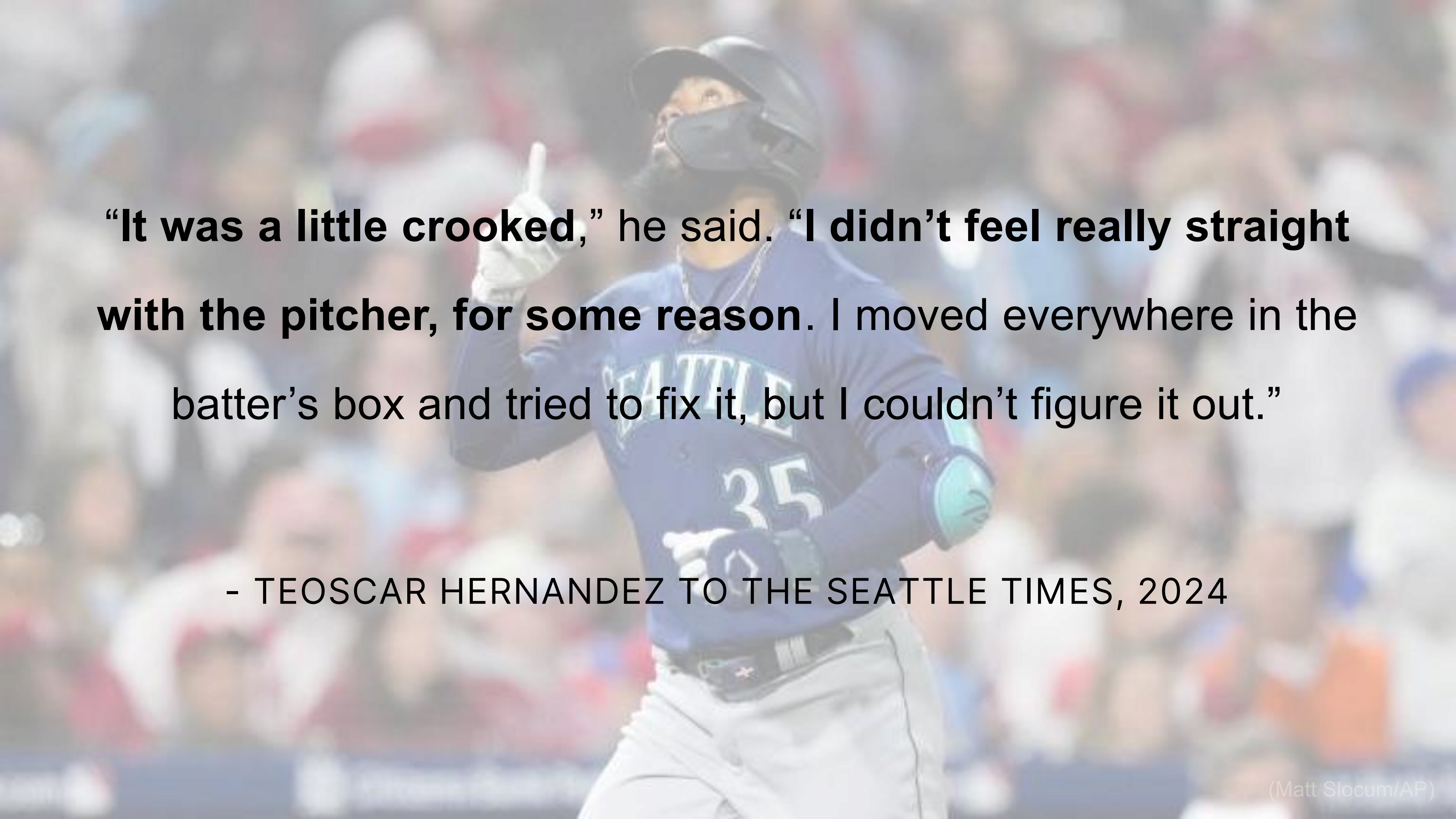
Humans are bad at Depth Perception



Parallel batter's eye



Slanted batter's eye

A baseball player, Teoscar Hernandez, is shown in a blue Seattle Mariners uniform with the number 35. He is wearing a batting helmet and a face mask, and is pointing his right index finger upwards. The background is a blurred crowd of spectators.

“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



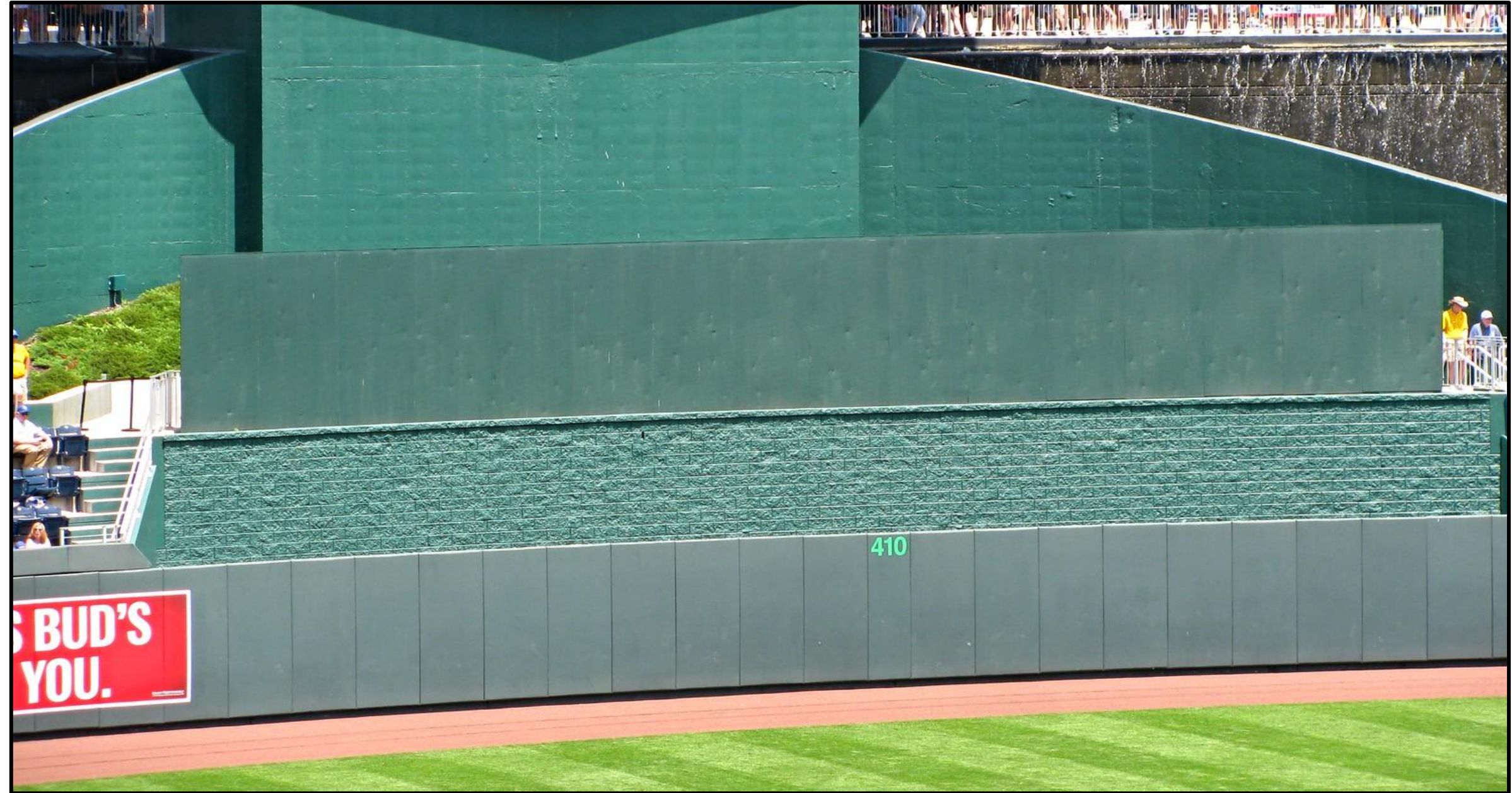
The Hardball Times

KANSAS CITY: KAUFFMAN STADIUM

Day: 97

Night: 87

- Flat, plain green surface
- Perpendicular to the batter



@timmer82 on flickr

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

Angled surfaces = changing depths as the hitter tracks the pitch

TEXTURES

Nature/foliage can make it hard to pick up the baseball

COLORS

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

- Whiff rates are used heavily in evaluations, especially at the amateur level. By better understanding the environment these whiffs occur in you can have a competitive advantage
- Real vs Feel. This project was able to prove and quantify that hitters experience a difference park to park

Questions?

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- linkedin.com/in/g-appelbaum/

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

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