MLB Umpire Ball/Strike Judgment and Decision Making Expertise

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The Concept of Expertise

- Chess experiments
- Expert/novice differences
- Shown game board arrangement
- Task:
  - 5 seconds to look
  - Describe available moves
  - Describe most strategic move
  - Predict action
Experts vs. Novices

• No real difference in visual skills
• Experts consistently demonstrate:
  – Selective attention
    • Complex organization of knowledge
  – Advance cues
    • Identify/recognize patterns in environment
    • Predict/anticipate action
  – Situational probabilities
    • Ability to prepare for many potential outcomes
Measuring Umpire Expertise

- Strike zone
- 275 – 300+ pitches per game
  - 2012 leader: Joe West (295 pitches p/g)
  - 10,914 during season
- 100 – 125 decisions per game
- How can we analyze those decisions?
• K-Zone and Sportvision technology

• MLB Gameday Directory

– http://gd2.mlb.com/components/game/mlb/
Variables:

[X] "X"  "X.1"  "date"  "game"  "umpire"
[6] "away_team"  "home_team"  "p_id"  "p_lname"  "p_fname"
[11] "p_dob"  "p_thorws"  "p_tm"  "b_id"  "b_lname"
[16] "b_fname"  "b_dob"  "b_height"  "b_hand"  "b_tm"
[21] "inn"  "pitch_con"  "type"  "pdes"  "tfs"
[26] "pitch_type"  "ab_id"  "ab_count"  "ab_total"  "time"
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[36] "millis"  "start_speed"  "end_speed"  "sz_top"  "sz_bot"
[41] "y"  "px"  "vx0"  "vy0"  "x"
[46] "pfx_x"  "pz"  "b_name"  "break_angle"  "spin_rate"
[51] "y0"  "az"  "nasty"  "break_y"  "mt"
[56] "z0"  "zone"  "sv_id"  "spin_dir"  "mt"
[61] "ax"  "b_sz_top_mn"  "rb_upper"  "break_length"  "home_team_runs"
[66] "b_name"  "away_team_runs"  "sv_id"  "cc"  "mt"
### Rogers Hornsby Chapter 2013 Winter Meeting

**PITCHf/x**

- **1/13/13**
- **Aaron Baggett & Grant Morgan**

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``` r
> sz.test <- tail(Y2011, 225)
> attach(sz.test)
> head(sz.test)
```

| X  | X.1  | date       | game | umpire | away_team | home_team | p_id   | p_lname | p_fname | p dob | p_throws | p_height | b_id   | b_lname | b_fname | b dob | b_hand | b_tm   | inn | ab | id | ob | ab_total | time | pitch_type | pitch_con | type | grade | des | tfs | mllis | R1  | R2  | R3  | x
|----|------|------------|------|--------|-----------|-----------|--------|--------|---------|-------|----------|-----------|--------|--------|---------|------|-------|-------|-----|-----|-------|------|----------|----------|------|-------|-----|-----|------|-----|-----|-----|

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| b tm | inn | ab | id | ob | ab_total | time | pitch_type | pitch_con | type | grade | des | tfs | mllis | R1  | R2  | R3  | x
|------|-----|----|----|----|---------|------|------------|----------|------|-------|-----|-----|------|-----|-----|-----|
| Ian Desmond walks. 161149 1.317241e-12 NA NA NA 115.88
| Ian Desmond walks. 161149 1.317241e-12 NA NA NA 30.04
| Roger Bernadina ground bunts into a force out, catcher Brett Hayes to shortstop Emilio Bonifacio. 161259 1.317241e-12 435622 NA NA 136.47
| Roger Bernadina to 1st. 161259 1.317241e-12 435622 NA NA 125.32
| Jayson Werth strikes out swinging. 161335 1.317241e-12 465668 NA NA 96.14
| Jayson Werth strikes out swinging. 161433 1.317241e-12 465668 NA NA 100.43

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| y start_speed | end_speed | sz_top | sz_bot | pfx_x | pfx_z | px | pz | x0 | y0 | z0 | vz0 | vy0 | vx0 | vz | ax | oy | oz | break_y | break_angle | back_length | zone | nasty | spin | dir | spin_rate | home_team_runs | away_team_runs | sv_id | cc | mt | rb | upper | b_name | b_sz_top_mn
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Evolution of the Strike Zone

• Before 1907
  – Batter’s could request location (high, low, fair)
  – Umpire’s role minimal

• 1907
  – Traditional pitch count began (4/3)
  – Strike zone standardized
    • “. . .any portion of the home base between the batsman's shoulder and knees. . .”
Evolution of the Strike Zone

• 1950
  – “. . . that space over home plate, which is between the batter's armpits and the top of his knees when he assumes his natural stance. . .”

• 1963
  – “. . . that space over home plate, which is between the top of the batter's shoulders and the top of his knees when he assumes a natural stance. . .”
Evolution of the Strike Zone

• 1969
  – “. . . that space over home plate, which is between the batter's armpits and the top of his knees when he assumes his natural stance. . .”

• 1988
  – “. . . that area over home plate the upper limit of which is a horizontal line at the midpoint between the top of the shoulders and the top of the uniform pants, and the lower level is a line at the top of the knees . . .”

Willie McCovey
Off. WAR: 8.6

Don Mattingly*
“Did not lead in WAR, but should have”
Evolution of the Strike Zone

• 1996
  – Lower limit of the strike zone expanded
  – From the top of the knees to the bottom of the knees

Barry Bonds
Off. WAR: 8.6

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Evolution of the Strike Zone

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Most analysis is done based on a typical strike zone
Prevents meaningful analysis
Negates rule book zone
Account for batter height
Variability in PITCHf/x operators
Strike Zone Standardization

- Most analysis is done based on a typical strike zone
- Prevents meaningful analysis
- Negates rule book zone
Strike Zone Standardization

- Account for batter height
- Variability in PITCHf/x operators
- Length is variable
- Width is exact
- Start with the baseball
The Baseball

- Dimensions are standardized (Rule 1.09)
  - Weight: $5 \leq 5.25$
  - Circumference: $9 \leq 9.25$
  - Diameter: $2.864 \leq 3.142$
  - Radius: $1.43 \leq 1.57$
The Actual Strike Zone

Varies by batter height and stance

.1309’

1.4166’

1.6784’

.1309’
Accuracy Inside & Outside

• Calculated the minimum distance each pitch was from the nearest edge of the strike zone
• To determine at what point umpires begin to demonstrate accuracy in judgment
• 85% - 91% accurate
Accuracy Inside & Outside

![Histogram showing accuracy inside and outside with a peak at 2 dist units and a decrease as distance increases.]

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General Accuracy
Estimating Strike Zone Length

- U.S. Army anthropometric measures
  - 25,000+ individuals
  - 5’1” – 6’10”
  - Shoulder height
  - Waist height
  - Suprasternal
  - Difference = upper limit
  - 6’0”: 51.46”/4.288’
Concentration & Attention

- Judgment and decision-making susceptible to bias
  - Catcher framing
  - Team/player retaliation
  - Pitch velocity (90+ MPH .485 - .385ms)

- Perceived and experienced anxiety/stress
  - Injuries
  - Catcher confrontations
Umpire Injuries

http://goo.gl/OVc2N
Umpire confronts catcher

http://goo.gl/NX6EG
Next Steps

• Continue strike zone analysis in order to better understand umpire accuracy
• Apply more robust statistical procedures to data
• Field testing
Thank you!

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