



Citrus Circuits  
Fall Workshop Series

# Game Analysis

by Austin Haddox

# Who Am I?

- Austin Haddox
- Strategy, Scouting, and Mechanical Mentor
- Data Modeling and Reporting Consultant
- Going into 11th season in FRC
- Started mentoring 1678 in 2019



# Overview

- Types of Analysis
- Understanding a Game
- Scoring Systems
- Kickoff
- Competition Season



# Purpose of Game Analysis

- Better understand the game
- Guide design decisions (The Whats)
- Create match strategies
- Create goals for your team





# Types of Analysis

# Types of Analysis

- Holistic Analysis
  - Using FRC knowledge to evaluate a game
- Numerical Analysis
  - Bringing a game to numbers to understand tradeoffs





# Understanding a Game

# Understanding a Game

- Ways to score
- Scoring Systems
- Reading the rules
- How will the game be played





# Golden Rule #1

Learn about previous games

- Research what kinds of tasks we've seen in previous years
- What strategies and designs were successful in those games
- How much do teams normally score



# Different ways to score: Auto/Teleop

- Auto/Teleop Scoring Method
  - Single element (2011-2014, 2016, 2018, 2020, 2022)
  - Multiple elements (2011, 2015, 2017, 2019)
  - Continuous cumulative scoring (2012, 2013, 2016, 2017, 2019, 2020, 2022)
  - Threshold achievement scoring (2014, 2015, 2017)
    - Qualification Ranking converts to score in Playoffs (2012, 2016, 2017)
  - Possession time (2018)
- Auto/Teleop Scoring Limit
  - Uncapped (2012-2014, 2016-2017, 2020, 2022)
  - Capped (2015, 2018, 2019)



# Different ways to score: End Game/Rank

- End Game Scoring Method
  - Single task / dual task (2012, 2013, 2016-2020)
  - Staged tasks (2013, 2019, 2022)
  - Assisted task (2012, 2018, 2019, 2020)
  - Ordinal (2011)
  - None (2014, 2015)
- Ranking
  - Wins/ties only (2011-2014)
  - Qualification Score (2015)
  - Bonus achievements
    - Coopertition (2012)
    - Dual achievements/thresholds (2016-2022)





# Scoring Systems

# Different Types of Scoring Systems

- Linear
  - Single scoring opportunity per cycle (2014, 2016, 2019)
  - Many scoring opportunities per cycle (2012, 2013, 2015, 2020)
- Non-Linear
  - Step Scoring
    - Threshold (2016-2020)
    - Series (2017, 2020)
  - Dependent Scoring
    - Multiplicative Bonus (2015)
    - Additive Bonus (2014, 2018)
  - Ordinal ranking (2011)
- Max Score
  - Max Number of game pieces or scoring opportunities (2017, 2019)
  - Max number of total points between the two alliances (2015, 2018)
- Unlimited Scoring



# Linear Scoring

- A Linear Scoring System is a system that grants points for every game piece that is scored.
- Single Scoring Opportunity: A system that has you score either one game piece or one set of game pieces at a time.
  - Example: Score one ball or one item per cycle and get points per ball or item.
- Multiple Scoring Opportunities: A system that allows you to score multiple game pieces per cycle.
  - Examples: 1) Shooting multiple balls or items per cycle. 2) Score multiple crates on a platform per cycle and get points for every crate scored.

**Focus on max carrying capacity and how we score!**



# Non-Linear Scoring

- Step Scoring: A system that does not grant points for every piece scored
  - Threshold: Once you score X amount of game pieces or score X amount of points then you get points.
    - Example: 1) You get 50 points after you score 10 balls. 2) RPs are often thresholds
  - Series: Having multiple thresholds of scoring.
    - Example: 1) You get 50 points for every 10 items you score. 2) You get 50 points for scoring 10 balls, 50 more points for scoring an extra 15 balls, etc. (Normally these have only a few thresholds)

**Focus on how many cycles are required to score points and see if the extra time is worth the points!**



# Non-Linear Scoring

- Dependent Scoring: A system that only grants points once something else is done
  - Multiplicative Bonus: Grants a bonus of points relative to another scoring method.
    - Example: 1) If you score a brick you get 0 points. However, if you do, your next cycle is worth 30 points rather than 10 (3x).
  - Additive Bonus: Grants a bonus of points once you score your cycle
    - Example: 1) If you score a brick you get 0 points. However, if you do, your next cycle is worth 15 points more than normal (+15).

**Focus on what percentage of a max score cycle is from bonuses and decide if it is worth the extra time!**





# Max Score vs Unlimited Scoring

- Max Score

- Max Number of game pieces or scoring opportunities

- Example: You only have 20 balls per alliance. Balls do not get reintroduced when scored and opponents can't control your balls.

**Focus on scoring every ball and stopping your opponents from scoring at least one ball!**

- Max number of total points between the two alliances

- Example: 1) There are 100 possible points in the match (differential scoring).

**Focus on scoring at least 51 points, it doesn't matter what your opponents do because every point you score is one less that your opponents can.**

- Unlimited Score

- Example: 1) There are 50 balls on the field, but balls get reintroduced when scored.

**Focus on optimizing score by scoring either more per cycle or more cycles! This is a multiplicative relationship for your total score.**





Kickoff

# Kickoff

- Game Animation
- Reading the rules
- Analysis
- Discussion



# Golden Rule #2

Read the game manual!

- Understand every inch of the key sections
  - Arena
  - Match Play
  - Scoring
  - Rule Violations
  - Game Rules



# Golden Rule #3

Spreadsheets Spreadsheets Spreadsheets!

- Using spreadsheets can help you quickly evaluate tradeoffs and strategy decisions



# Scoring Calculators

- Input Sheet
  - Per robot
  - Editable
- Calculate totals for alliance
  - Points
  - RP
- Try different combinations
  - Karthik's rule of (2-4-8)



Team Info	Blue Alliance			Red Alliance		
Scoring Data	B1	B2	B3	R1	R2	R3
<b>Auto</b>						
Taxied?	Yes	Yes	Yes	Yes	Yes	Yes
#Low Goal	2	0	0	5	0	1
#High Goal	1	5	0	0	0	4
<b>Teleop</b>						
#Low Goal	3	0	5	3	0	4
#High Goal	7	20	0	15	8	0
Climb Level	Medium	Traversal	None	Low	None	Low
<b>Team Scores</b>						
Auto	8	20	0	10	0	18
Teleop	17	40	5	33	16	4
Climb	6	15	0	4	0	4
Total Score	31	75	5	47	16	26
<b>Final</b>						
Alliance Score	111			89		
Cargo RP	1			1		
Hanger RP	1			0		
Winning RP	2			0		
Total RP	4			1		

# Golden Rule #4

## Understand Cycles

- Karthik's rule of (2-4-8)
  - Full field cycles under perfect conditions







# Competition Season

# Competition Season

- Competitions
- Scouting
- Analysis
- Data Visualization



# Golden Rule #5

## Watch Competitions!

- Watch the game be played
- Evaluate how your team compares to others
- Find unique autos/strategies
- Defense



# Scouting

- Collect data on robots
- Match strategy
- Picklist creation
- Store data for post competition analysis



# Analysis

- Review scouting data in after competitions
- Look at trends across weeks and regions
- Pre-Scout competitions
- Adjust your expectations as the season goes on



# Golden Rule #6

## Sykes Database

- Caleb Sykes collects TBA data
  - Every robot at every competition
  - Great for pre-scouting and evaluating
  - Updates it every week



# Data Visualization

- Graphs
- Charts
- Tables
- Tableau, Microsoft Power BI, Excel, Google Sheets



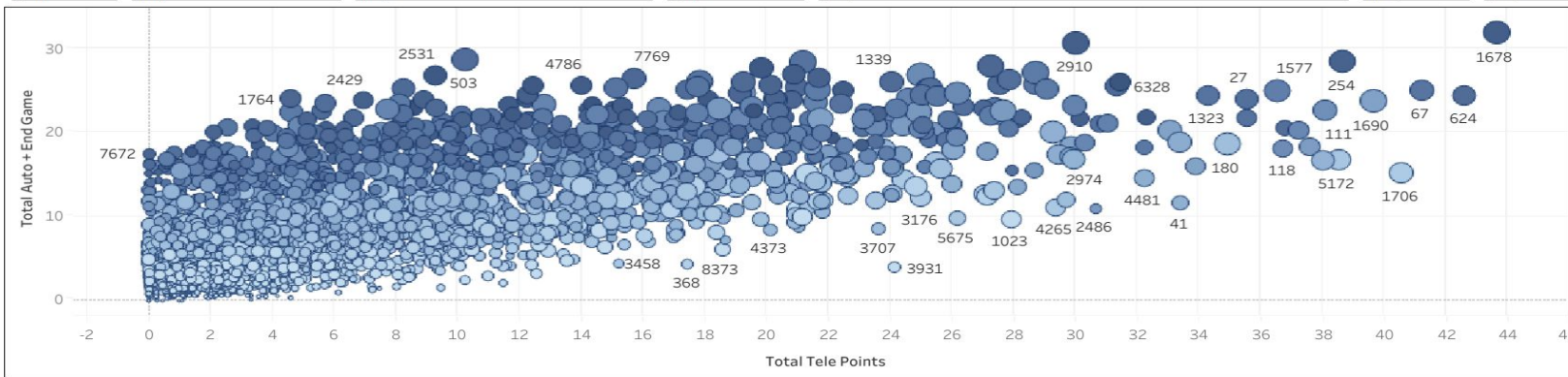
# 2022 FIRST FRC Rapid React: Overall Scoring Performance through Week 8

Analysis by 1918 NC GEARS, data provided by Caleb Sykes

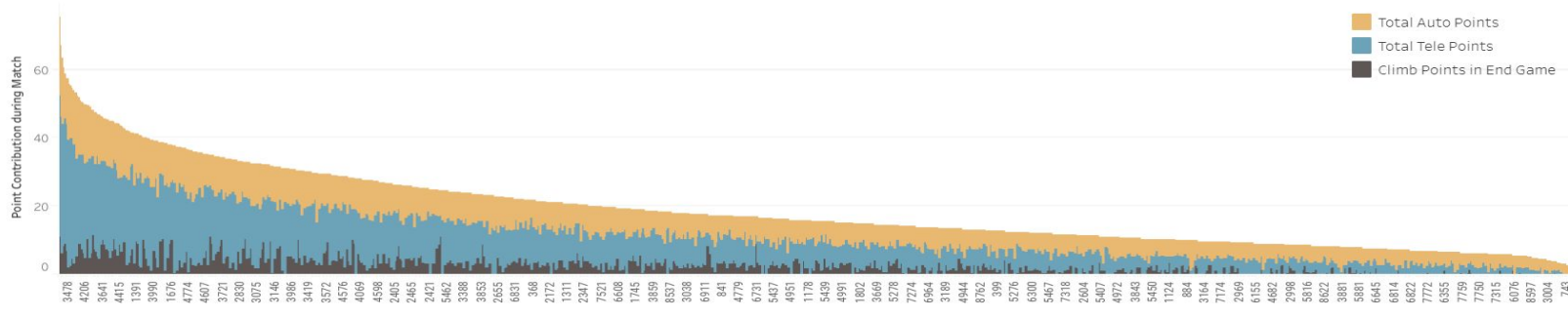
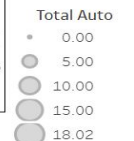
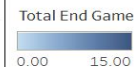
Click on or pause your mouse over a "dot" to see the team detail



Event Type: (All) | Country: (All) | State/Province: (All) | District: (All) | Past Event(s): (All) | Einstein Team?: (All) | Week: (All) | Highlight Team: Highlig...



\*\*The larger the circle, the more Auto Points  
 \*\*The darker the circle, the more Climb Points



Upcoming Event: (All)

**NOTE:** Due to issues with the cargo sensors at some of the events, "Total Tele Points" and "Total Auto Points" may not equal "Upper + Lower Cargo" because the latter may be high



# Summary

- Types of Analysis – Holistic & Numerical
- Understanding a Game – Golden Rules #1
- Scoring Systems – Linear vs Non-Linear & Max vs Unlimited
- Kickoff – Golden Rule #2, #3, and #4
- Competition Season – Golden Rule #5 and 6



# Resources

- Chief Delphi - [chiefdelphi.com](https://www.chiefdelphi.com)
- TBA - [thebluealliance.com](https://www.thebluealliance.com)





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# Questions?



## Give us Feedback!

