

Introduction

IMGD 2905

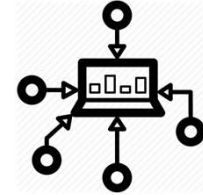
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What is data analysis for game development?

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What is data analysis for game development?

- Using **game data** to inform the **game development** process
- Where does this data come from?



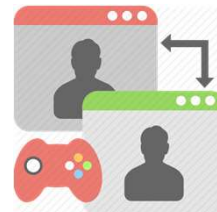
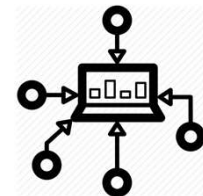
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What is data analysis for game development?

- Using **game data** to inform the **game development** process
- Where does this data come from?

→ *Players*, actually playing game

- **Quantitative** (instrumented)
- **Qualitative** (subjective evaluation)
- (But often lots more of the former!)



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What can game analysis do for game development?

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What can game analysis do for game development?

- **Improve level design** – e.g., see where players are getting stuck
- **Focus development on critical content** – e.g., see what game modes or characters are not used
- **Balance gameplay** – e.g., tune parameters for more competitive and fun combat
- **Broaden appeal** – e.g., hear if content/story is engaging or repulsing
- Note: game data often informs *players*, too
 - Analytics not dissimilar

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Why is data analysis for game development needed?

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Why is data analysis for game development needed?

- **Challenge**
 - Games gotten larger and more complex
 - Number of reachable states, characters
 - Game balance harder to achieve
 - Need for metrics to make sense of player behavior has increased
- **Opportunity**
 - New technologies enable aggregation, access and analysis

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IMGD 2905 – Doing Data Analysis for Game Development

- [Data analysis pipeline](#) – get data from games, through analysis, to stakeholders
- [Summary statistics](#) – central tendencies of data
- [Visualization of data](#) – how to display analysis, illustrate messages
- [Statistical tests](#) – quantitatively determine relationships (e.g., correlation)
 - Probability needed as foundation (also used for game rules)
- Regression – model relationships
- More advanced topics (e.g., [ML](#), [Data management](#) ...)

For this class:

Described in lecture
Read about in book
Applied in projects

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Foundations for Data Analysis @ WPI

- Statistics classes
 - MA 2610 Applied Statistics for Life Sciences
 - [MA 2611 Applied Statistics I](#)
 - MA 2612 Applied Statistics II
- Probability classes
 - [MA 2621 Probability for Applications](#)
- Data Science (minor and major)
 - [DS 1010 Introduction to Data Science](#)
 - [DS 2010 Modeling and Data Analysis](#)
 - DS 3010 Computational Data Intelligence
 - DS 4433/CS4433 Big Data Management and Analytics
- Data Mining
 - CS 4445 Data Mining and Knowledge Discovery in Databases
- Other
 - [CS 1004 Introduction to Programming for Non-Majors](#)
 - CS 3431 Database Systems I

Note – other Stats and Probability classes are primarily geared for Math majors

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Outline

- Overview (done)
- Game Analytics Pipeline (next)
- Game Data Analysis Examples

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Sources of Game Data

Quantitative (Objective)

- Internal Testing
 - Developers
 - QA
- External Testing
 - Usability testing
 - Beta tests
 - Long-term play data



Qualitative (Subjective)

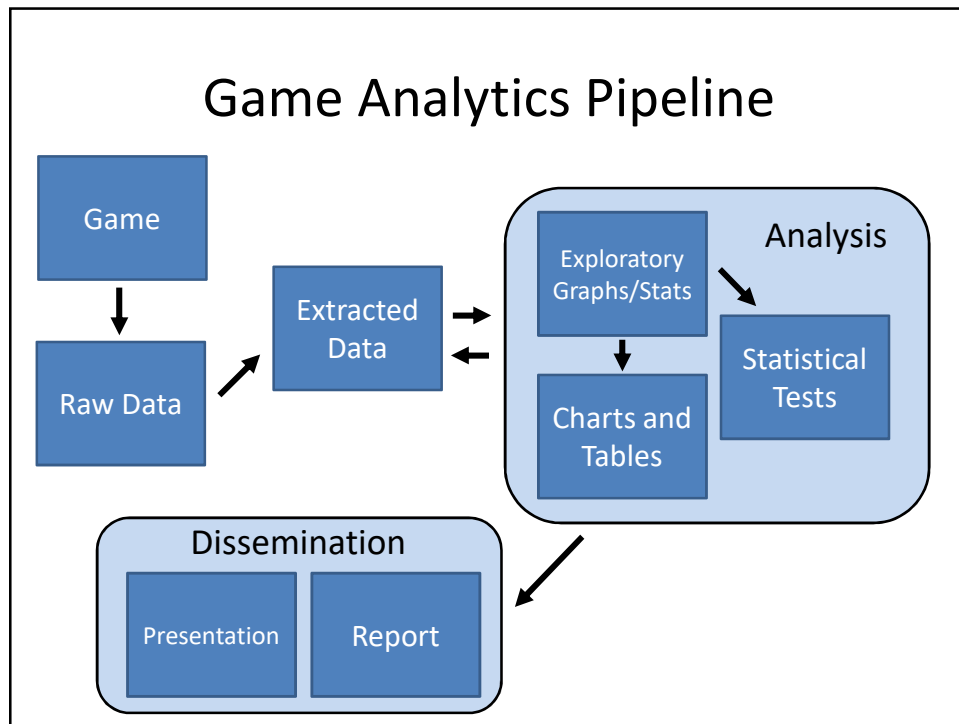
- Surveys
- Reviews
- Online communities
- Post mortems

SURVEY

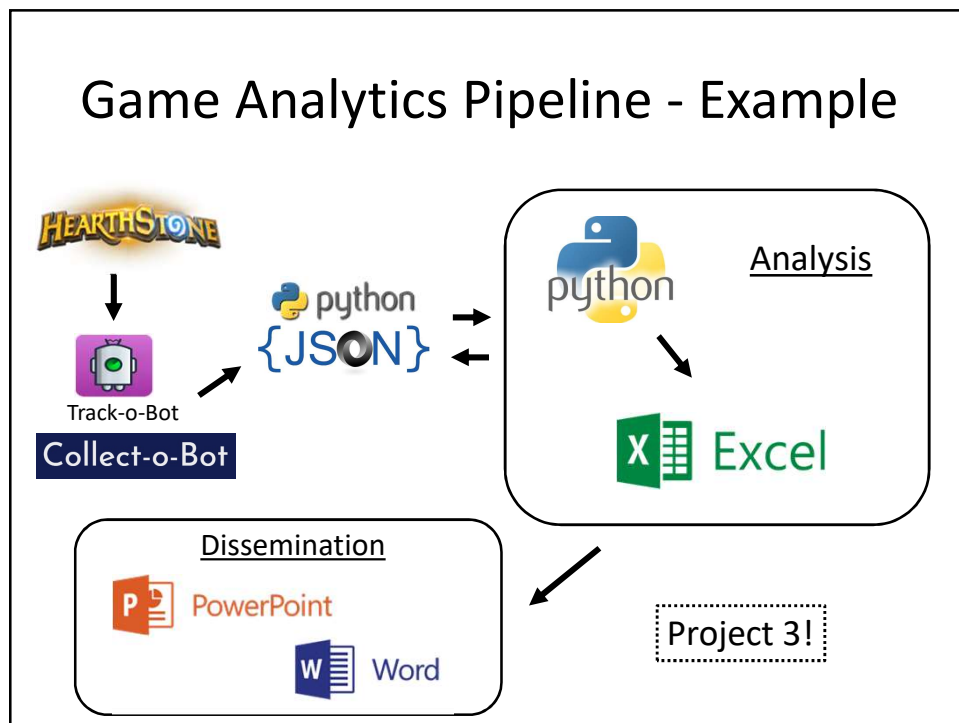
- ☒ EXCELLENT
 - ☐ AVERAGE
 - ☐ POOR
- <https://imgurl.com/y/3gpa4>

How to get from data to dissemination?
→ Game analytics pipeline

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Game Analytics Tools



- **Games** – breadth of experience with games, specific experience with game to be analyzed
- **Tools** – import, clean, filter, format data so can analyze
- **Statistics** – measures of central tendency, measures of spread, statistical tests
- **Probability** – rules, distributions
- **Data Visualization** – bar chart, scatter plot, histogram, error bars
- **Technical Writing** and **Presentation** – white paper, technical talk; audience is peer group, developers, boss

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Outline

- Overview (done)
- Game Analytics Pipeline (done)
- Game Data Analysis Examples (next)

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Example: Project Gotham Racing 4



K. Hullett, N. Nagappan, E. Schuh, and J. Hopson. "Data Analytics for Game Development", International Conference on Software Engineering (ICSE), May, 2011, Waikiki, Honolulu, HI, USA
<http://dl.acm.org/citation.cfm?id=1985952>



- Publisher – Microsoft 2007
 - 134 vehicles, 9 locations, 10 game modes
- Analyzed data
 - (Authors worked at Microsoft)
 - 3.1 million log entries, 1000s of users



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Project Gotham Racing 4: Results

<u>Game Mode</u>	<u>Races</u>	<u>% Total</u>
OFFLINE_CAREER	1479586	47.63%
PGR_ARCADE	566705	18.24%
NETWORK_PLAY	584201	18.81%
SINGLE_PLAYER_PLAY	185415	5.97%
...		
NET_TOURNY_ELIM	2713	0.09%
<u>Group</u>	<u>Races</u>	<u>% Total</u>
STREET_RACE	795334	25.60%
NET_STREET_RACE	543491	17.50%
ELIMINATION	216042	6.95%
HOTLAP	195949	6.31%
...		
TESTTRACK_TIME	7484	0.24%
CAT_N_MOUSE_FREE	3989	0.13%
CAT_N_MOUSE	53	0.00%

- Thoughts?
- What are some main messages?

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- **Mode**
 - *Offline career* dominates
 - *Network tournament* hardly used
- **Events**
 - *Street race* and *network street race* dominate
 - *Cat and mouse* never used
- **Vehicles** (not shown)
 - 1/3 used in less than 0.1% of races

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Project Gotham Racing 4: Conclusion

- Content underused - 30-40% of content in less than 1% of races
- Use to shift emphases for DLC, next version
 - Asset creation costs significant, so even 25% reduction noticeable
- Other (not shown)
 - Encouraging new players to play *career mode*
 - Increasing likelihood of continuing play
 - Encouraging new players to stay with *F Class* longer
 - Rather than move to more difficult to control *A Class*

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Example: Halo 3



B. Phillips. "Peering into the Black Box of Player Behavior: The Player Experience Panel at Microsoft Game Studios", *Game Developers Conference (GDC)*, 2010.
<http://www.gdcvault.com/play/1012387/Peering-into-the-Black-Box>

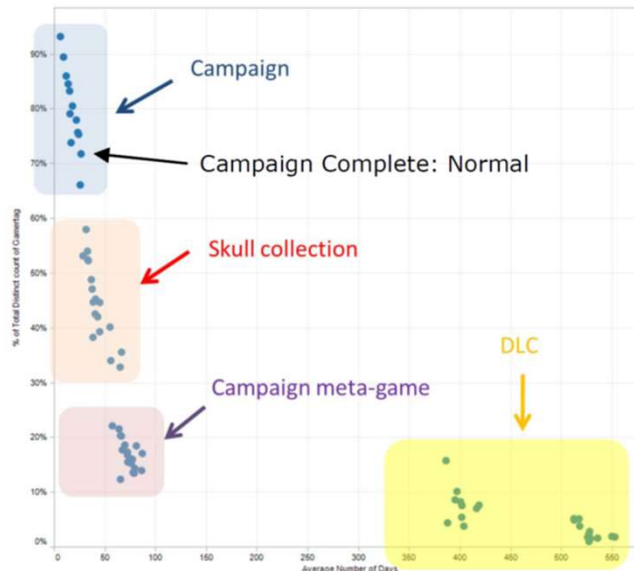


- Publisher – Microsoft 2007
 - Achievements: single player missions, challenges such as finding skulls, multiplayer accomplishments...
- Analyzed data
 - (Author worked at Microsoft)
 - 18,000 players



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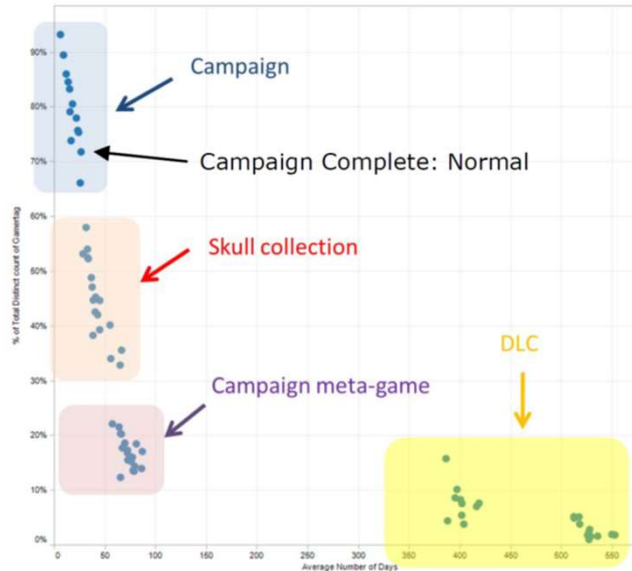
Halo 3: Results



- Thoughts?
- What are some main messages?

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Halo 3: Results



- 73% of players completed campaign
 - Can compare to other Xbox games
- Took 26 days to accomplish
- Double that time for all original content
- DLC provides users up to 2 years of content

Good Descriptive Example

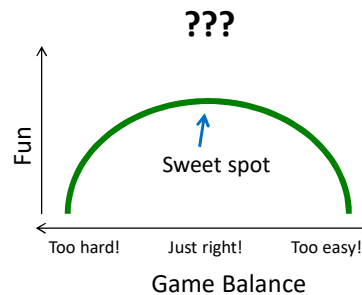
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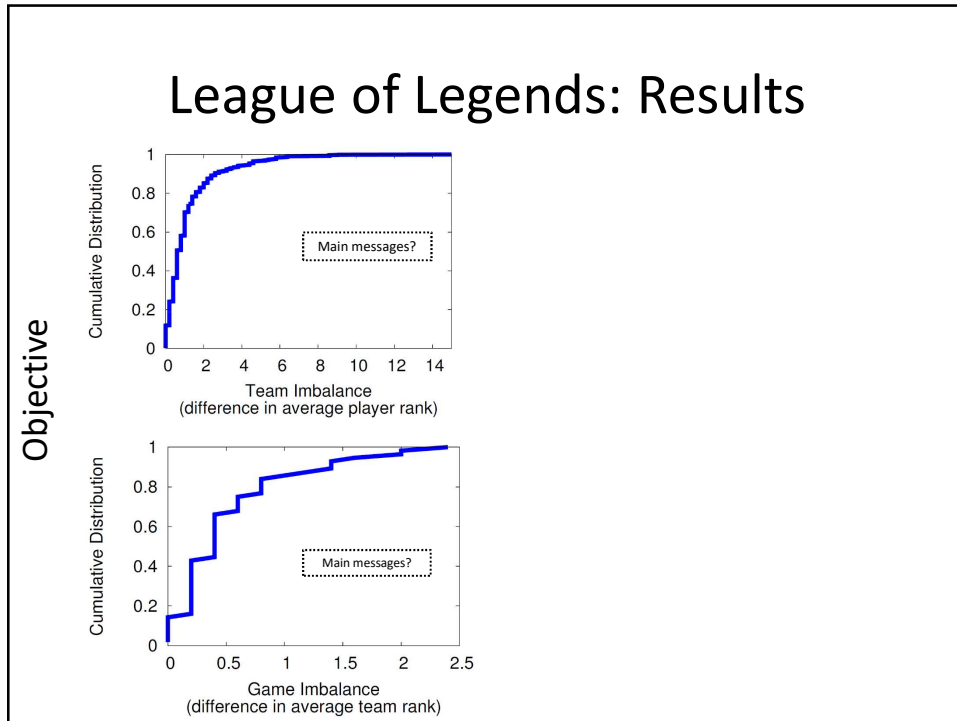
Example: League of Legends

Mark Claypool, Jonathan Decelle, Gabriel Hall, and Lindsay O'Donnell. "Surrender at 20? Matchmaking in League of Legends," In *Proceedings of the IEEE Games, Entertainment, Media Conference (GEM)*, Toronto, Canada, October 2015. Online at: <http://www.cs.wpi.edu/~claypool/papers/lol-matchmaking/>

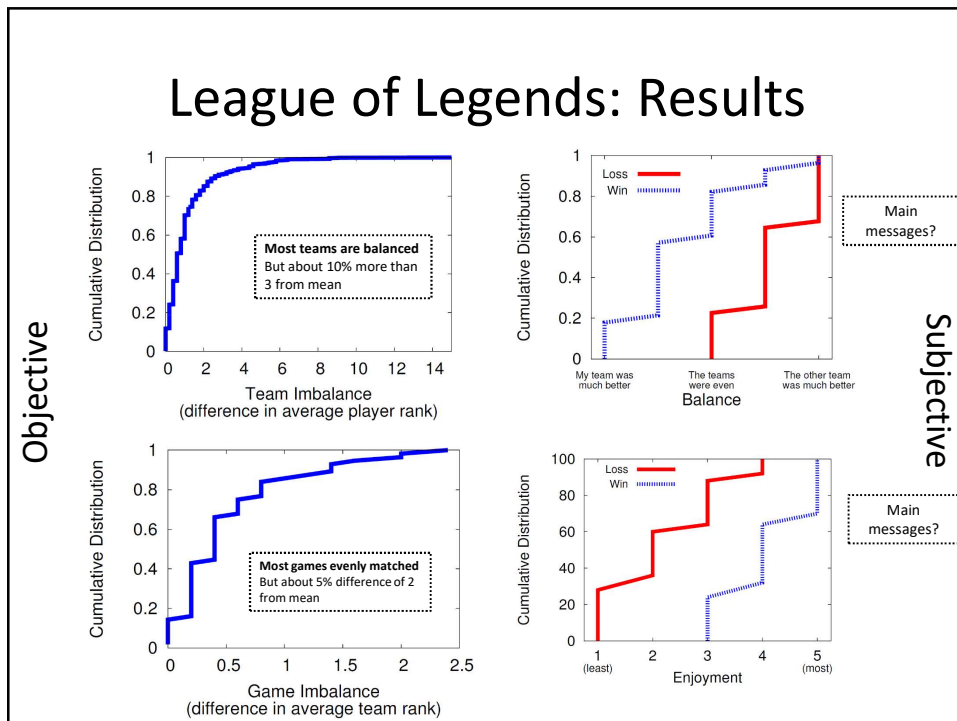
- Publisher – Riot Games 2009
 - Rank: ~5 Tiers, 5 divisions each → 25
- User study (52 players)
 - Play LoL in controlled environment
 - Record objective data
 - (e.g., player rank and game stats)
 - Provide survey for subjective data
 - (e.g., match balance and enjoyment)



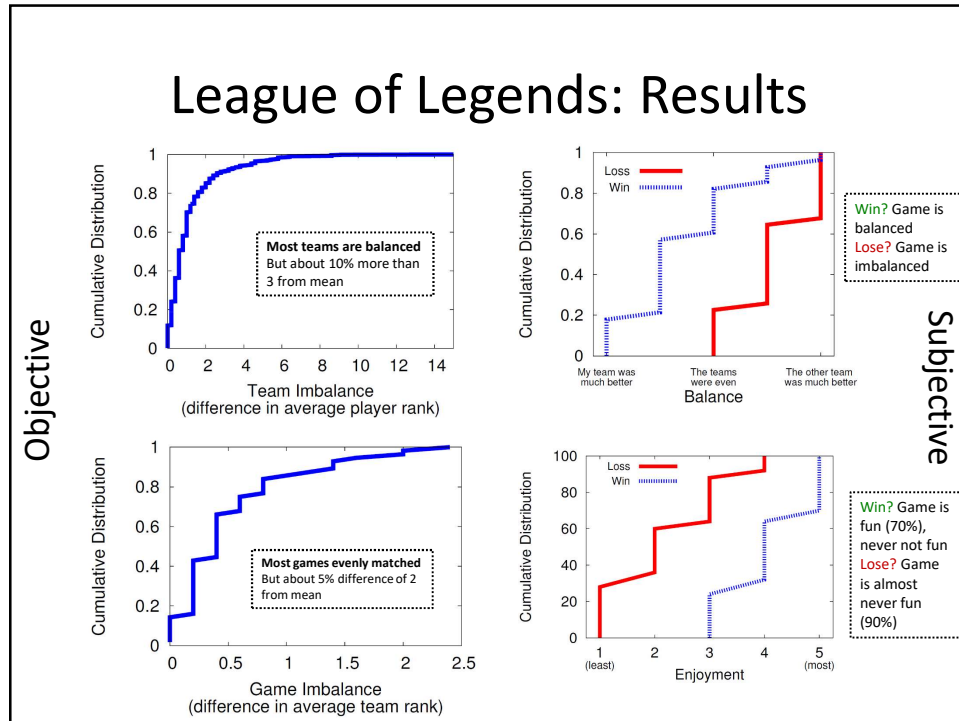
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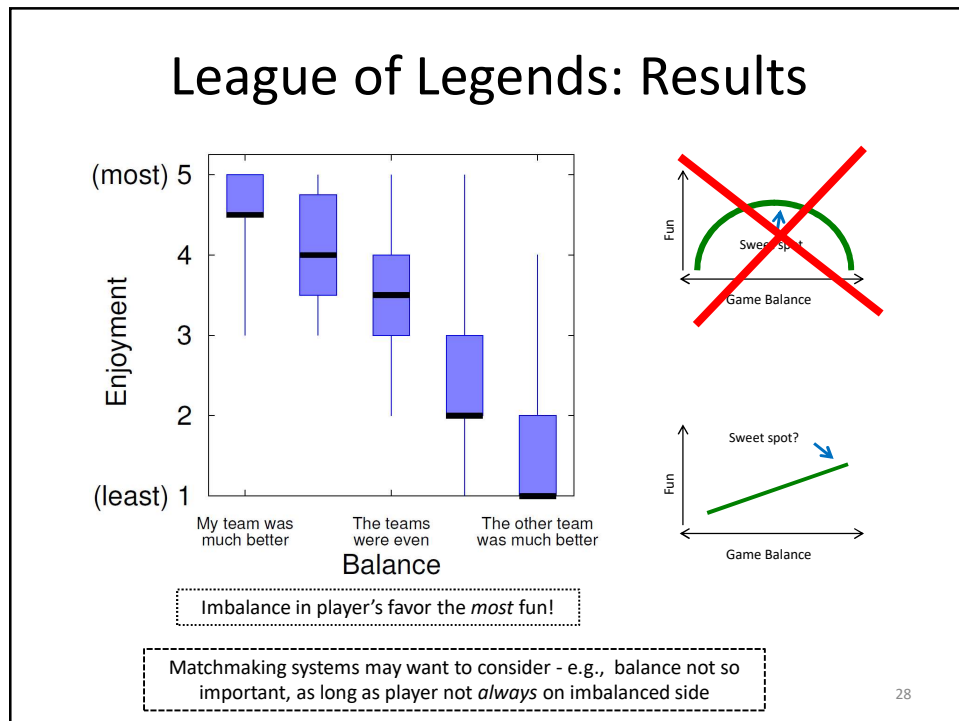
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Summary

- Data analysis for games increasingly important
 - Has potential to improve game development
- Knowledge and skills required
 - Scripting
 - Statistics
 - Data analysis
 - Writing and presentation



“Let’s get to it, already!”
-- Tracer (Overwatch)

