the gamedesigninitiative at cornell university

Lecture 17

Game Analytics

The Loss of a Course

- **CS/Info 4154:** Analytic-Driven Game Design
  - Course that focused on analyzing gameplay data
  - Games included code to record what players do
  - Students ran statistics to see what worked/failed
  - Student altered gameplay to meet certain targets
- **No longer exists** for two major reasons
  - The faculty member who ran it left Cornell (Eric!)
  - Depended heavily on Flash for larger player base

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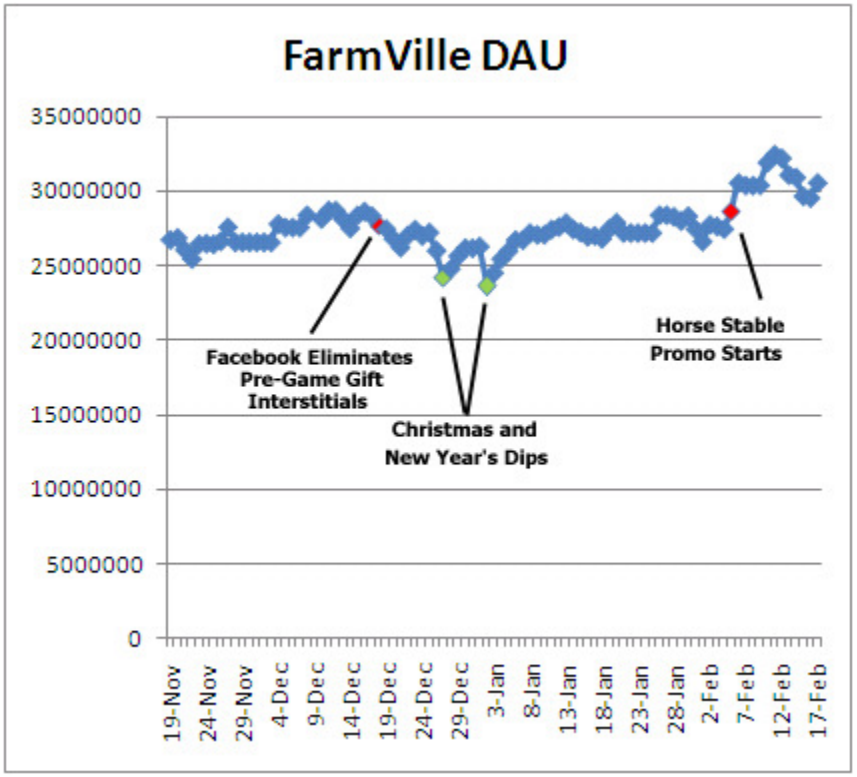
Unfortunate since more relevant that ever

The Role of Analytics

- Game development continues after you ship
  - Improvements to expand player base
  - Critical for DLC or in-game items

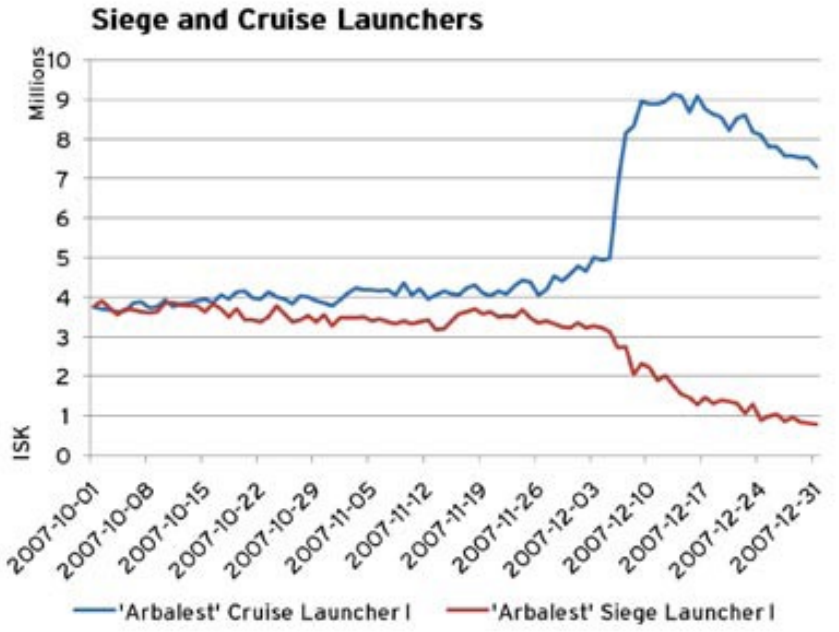
- Mixture of **business** and **game design**
  - How do you keep players playing the game?
  - What do they like? What makes them frustrated?
  - This is the new direction of game design
- Breaks down into **three categories**
  - Categories determined by data complexity

Player Activity Analytics



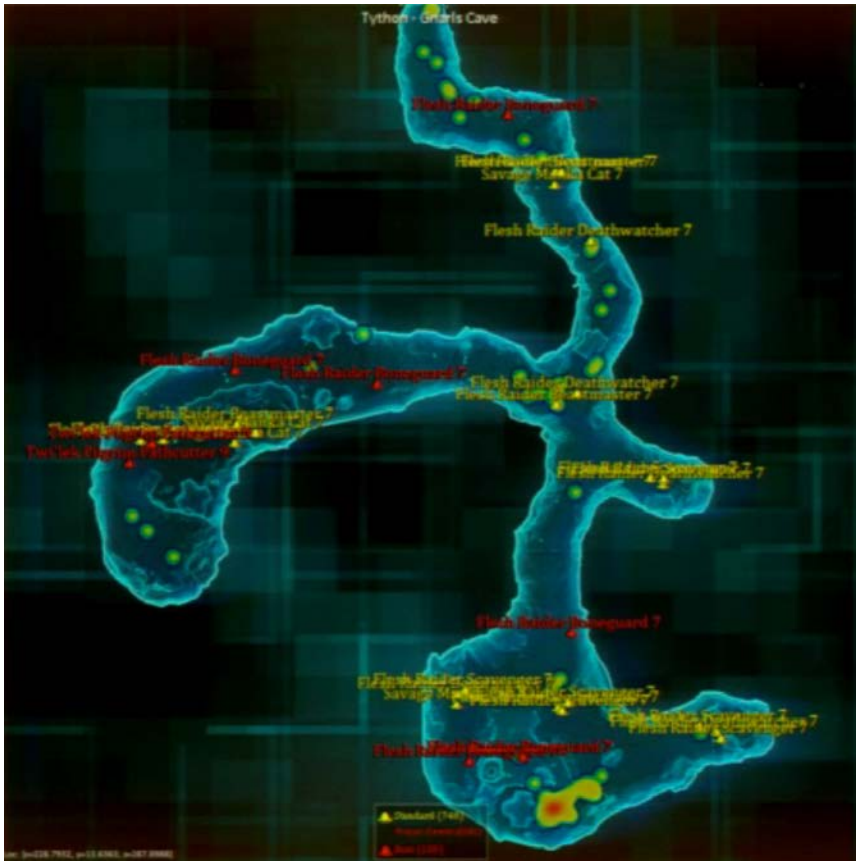
- **Data for a single player**
  - Or for a given player group
- **Examples**:
  - How often do they play?
  - When does the player quit?
  - Can we get the player back?
- Some support from platform
  - Generalities like play time
  - Found in Facebook, Steam
  - Custom solutions for more

Game System Analytics



- **Non-spatial game data**
  - Behavior of many players
  - Often the game economy
  - Also issues of game balance
- Needs custom data gathering
  - Data tailored to your game
  - And so are the data queries
- But visualization is easy
  - Query *formats* are standard
  - Can use existing viz tools

Spatial Data Analytics



- **Spatial game data**
  - Where are things happening
  - Critical for big MMOs
  - Also useful in level design
- Requires custom solutions
  - Custom data collection
  - Custom data visualization
- Complex tools made in-house by the game studios
  - Only worth it for big games

Player Analytics: Funnel Charts

1000 People Clicked on the Ad

880 People Downloaded App

650 People Created an Account

550 Entered Credit Card

200 Created a Character

180 Played 15 Minutes

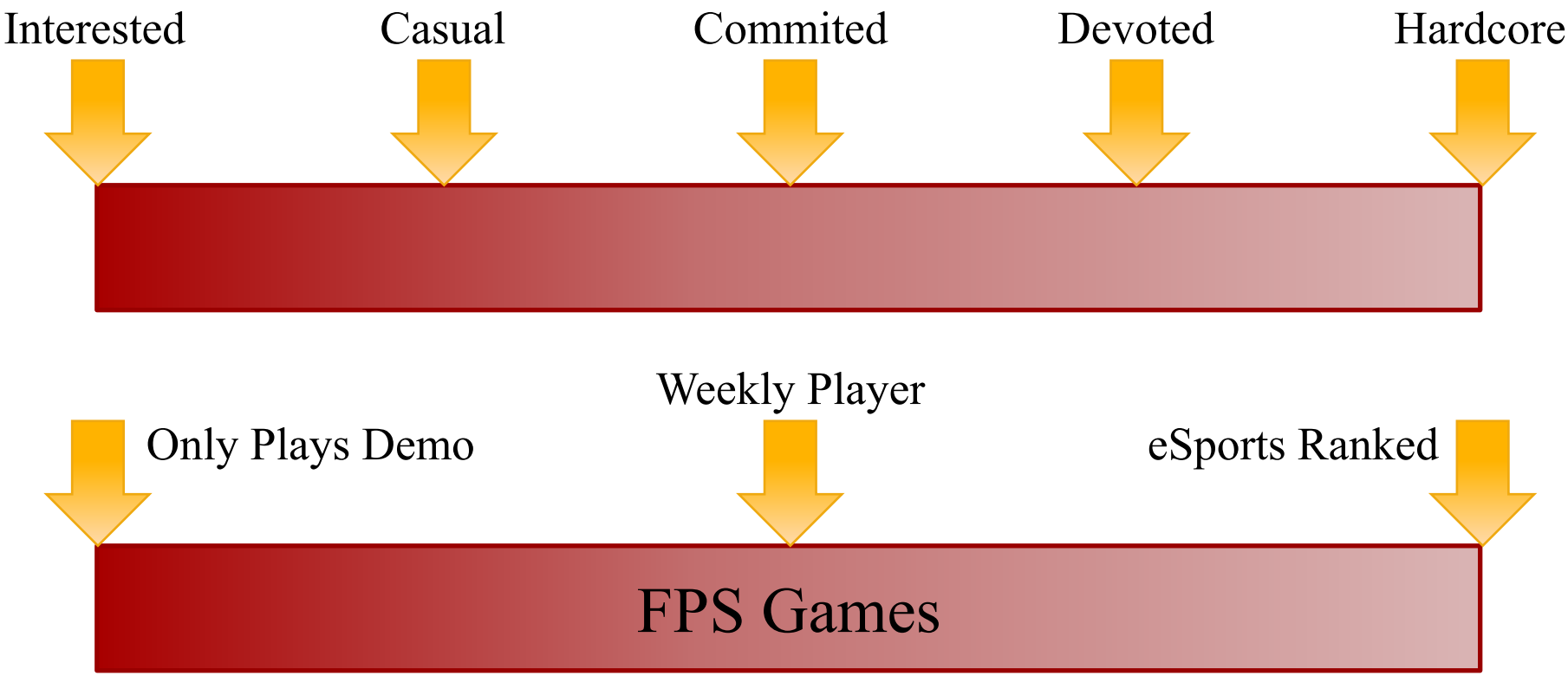
What Happened?

Funnel Charts and Design

- **Goal**: find "pain points"
  - When does player quit X?
  - Why doesn't player do Y?
  - Less pain = more accessible
- But do not necessarily want to eliminate them all
  - Easy game = casual game
  - Turns off hardcore players
  - Hardcore players are needed for almost any game (???)

Casual-Hardcore Spectrum

Casual and Core are property of **players**, not the **game**



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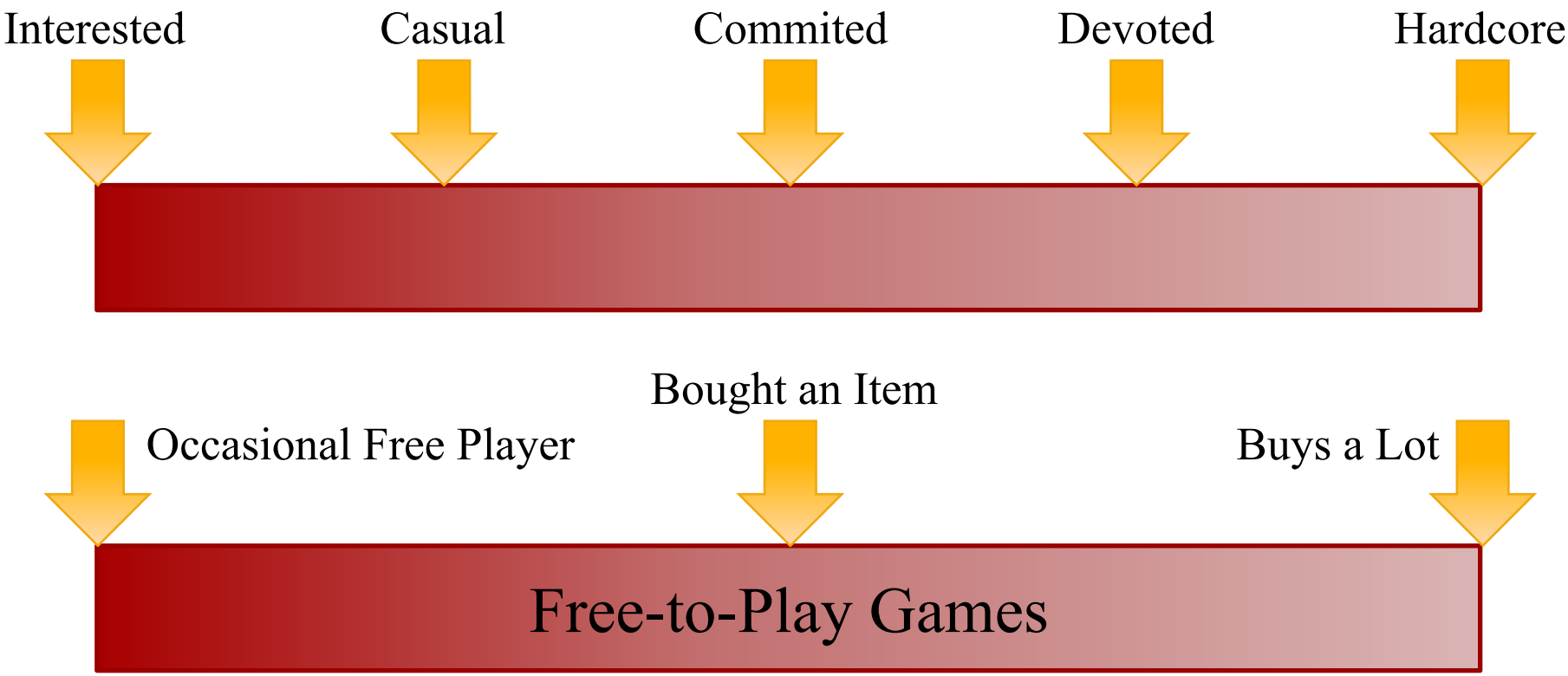

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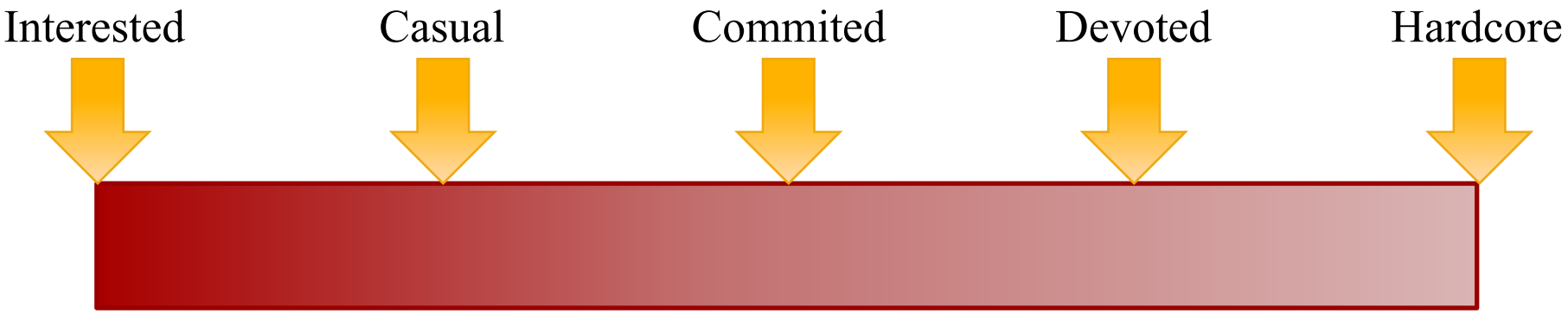
Goal of funnel is to find out how far apart these are



Casual-Hardcore Spectrum

Casual and Core are property of **players**, not the **game**

Goal of funnel is to find out how far apart these are

Game Specific Data

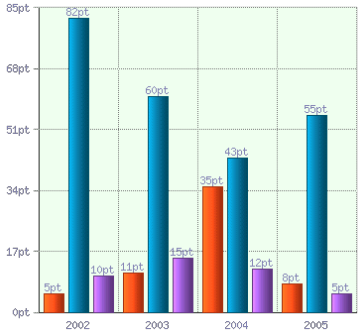
- Some funnel charts are game specific
  - Platforms only have the coarsest of data
  - Steam is not going to track quest completion
- This requires **custom instrumentation**
  - Functions called at specific activity
  - Record result of activity … *somewhere*
  - Almost exactly the same as profiling
  - Except that there are no pre-made tools

Logging Game Data

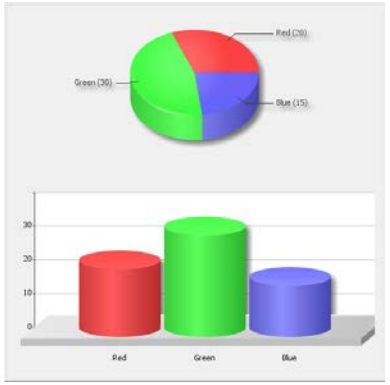
Log

Data Store

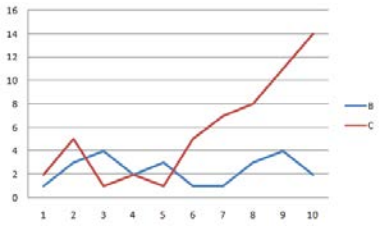
Query 1



Query 2



Query 3



Gameplay Analytics

- Focuses on mechanics, not individuals
  - Want to prioritize **non-spatial** game systems
  - Want systems that can be visualized numerically
  - Typically for **resources** and **game economies**
- Requires **custom instrumentation**
  - Need a custom server for analytics
  - Need an engine API to send data to server
  - Must manually add API calls to game

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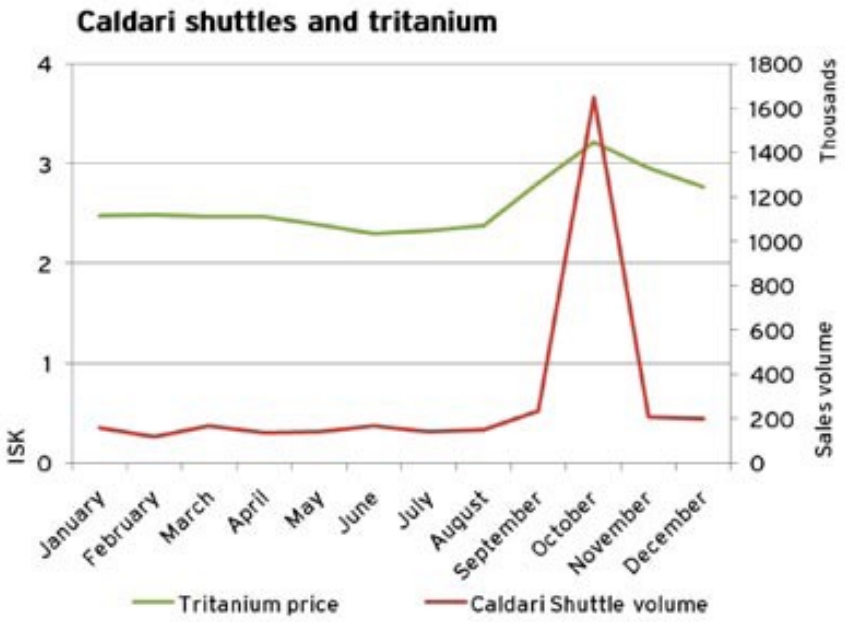
- Requires **custom instrumentation**
  - Need
  - Need
  - Must

Fall 2024 MEng Project.
Not yet integrated in CUGL.

MMO Example: *EVE Online*



- Shuttles can be reprocessed
  - Can turn back into minerals
  - Can use (for building) or resell these minerals
- Shuttles have a fixed cost
  - What if player is bankrupt?
  - Gives players a fallback
- Puts price cap on Titanium
  - If too much, buy shuttles
  - Do we like this design?

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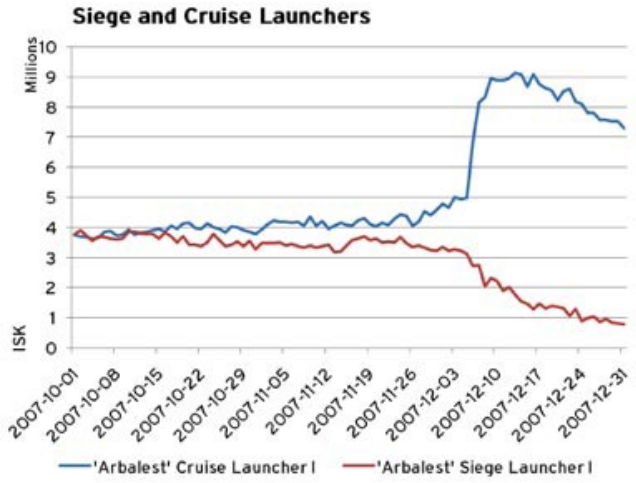
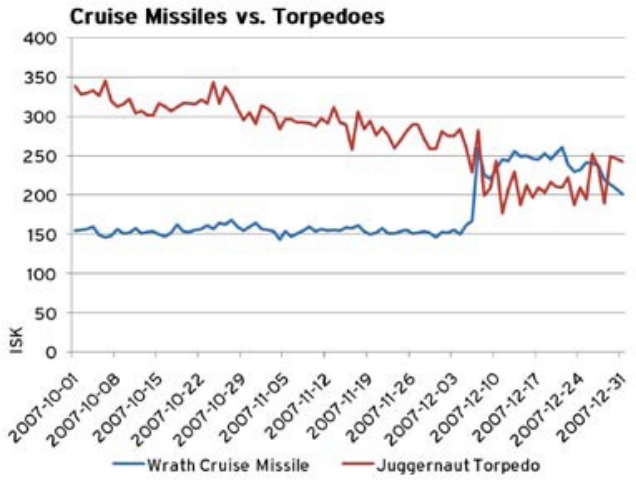
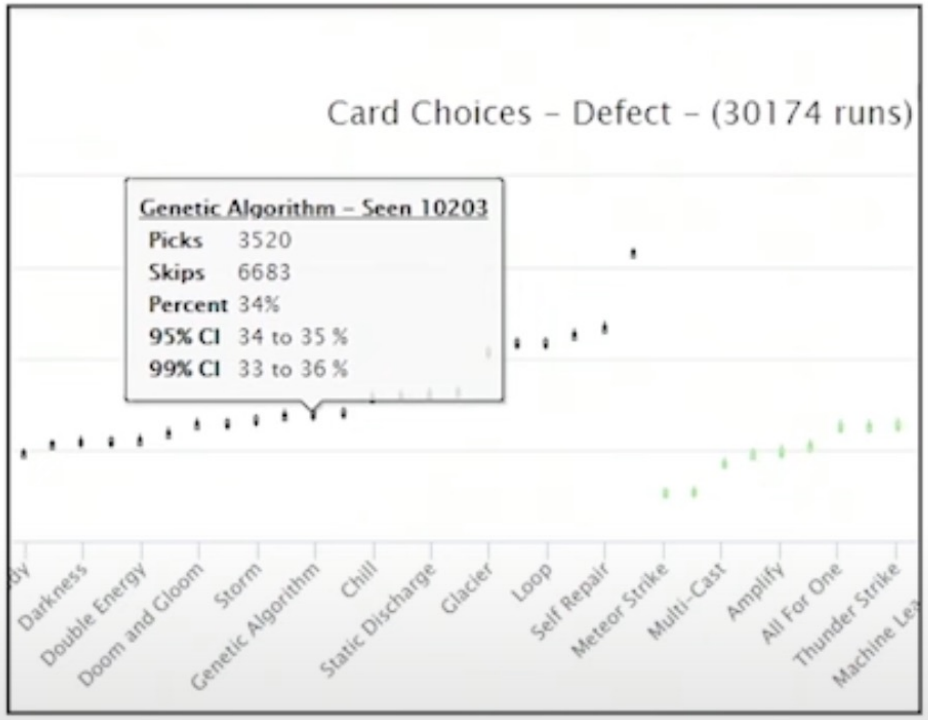
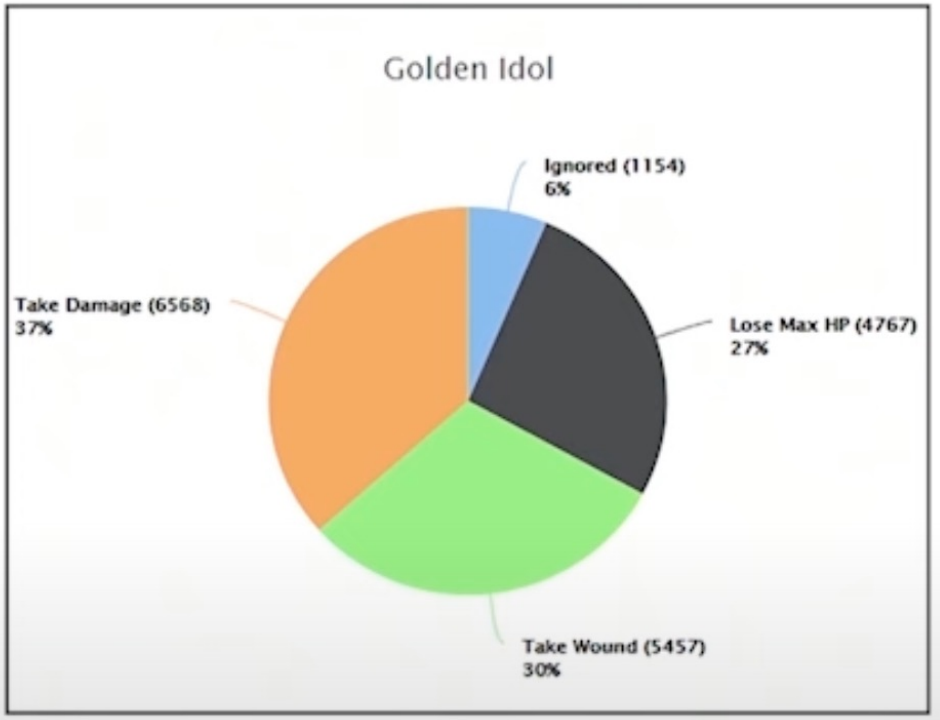




- *Trinity* altered gameplay
  - Changed torpedo mechanics
  - Range was made shorter
  - But rate of fire increased
- But players valued range
  - Torpedos volume dropped
  - Cruise Missiles spiked
  - Similar chart for launchers
- But this not mean that the redesign was a bad idea

Indie Example: *Slay the Spire*





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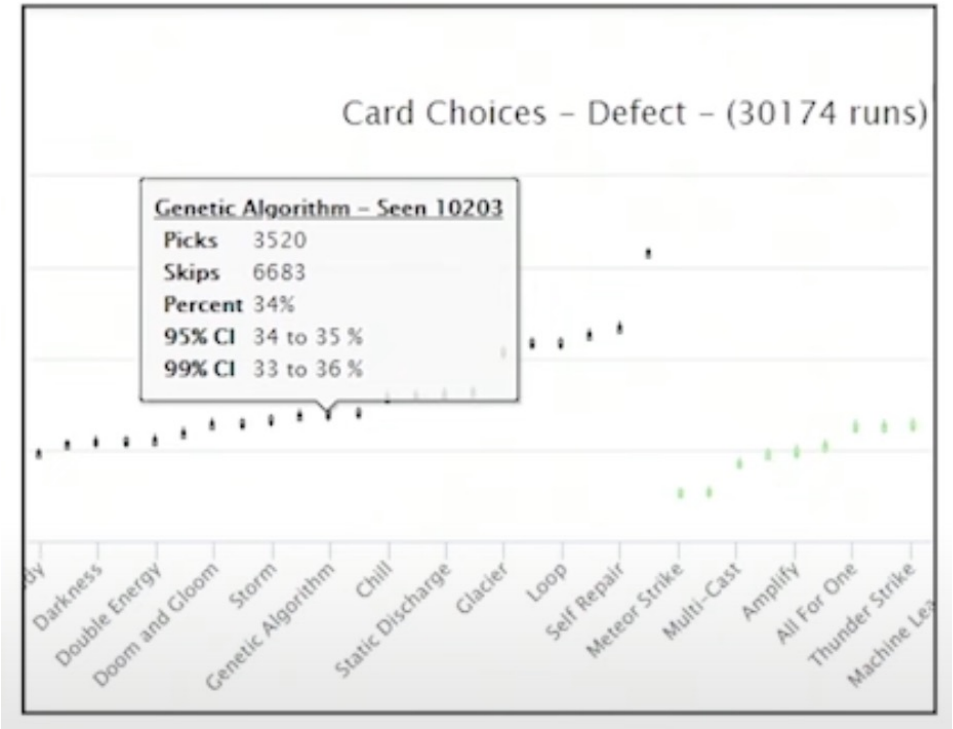
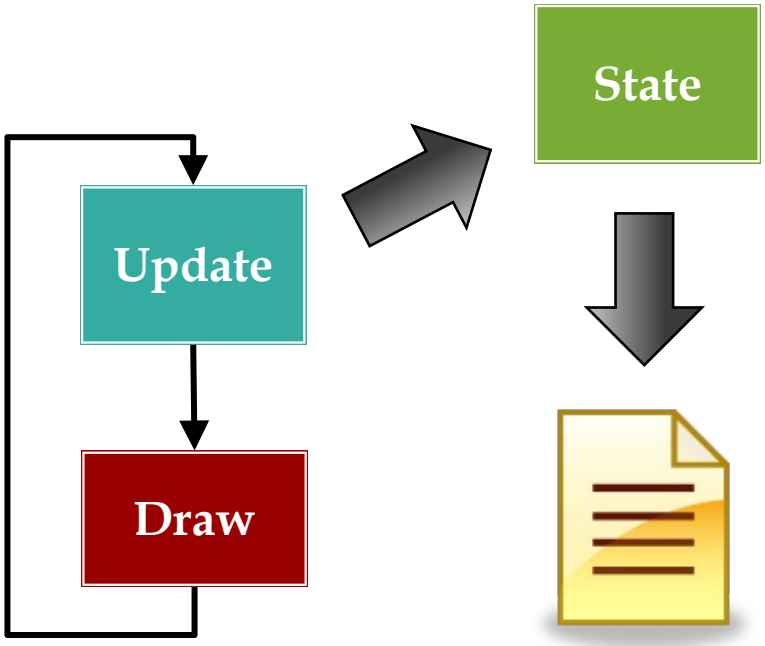


Goal: Game Balance

- Make every card **viable**
  - Doesn't mean equally good!
  - But must be part of a build
- Limit any **game warping**
  - Avoid "must pick" cards
  - Some build always excludes
- **Broken builds** okay but…
  - Only if occurrence is rare
  - Strategy cannot be grindy

Gameplay Analytics in Practice



- Need to log the game state
  - What actions player choses
  - What interactions occur
- Cannot collect everything
  - **Ex:** 500 objects w/ 10 fields
  - 1.2 MB/sec at 60 fps
- And what if you could?
  - How to search this data?
  - Databases are not miracles

Logging for Gameplay Analytics

- Consider **decision-significant** information
  - Look at your playtesting scripts
  - What exactly are you trying to test?
  - What information do you need to test it?

- **Walkthrough Example**

  Move the platform across the pit and then go back in time so the goomba will land on the platform and walk across. He will get the key from the tiny space for you. Grab the first puzzle piece and move on.

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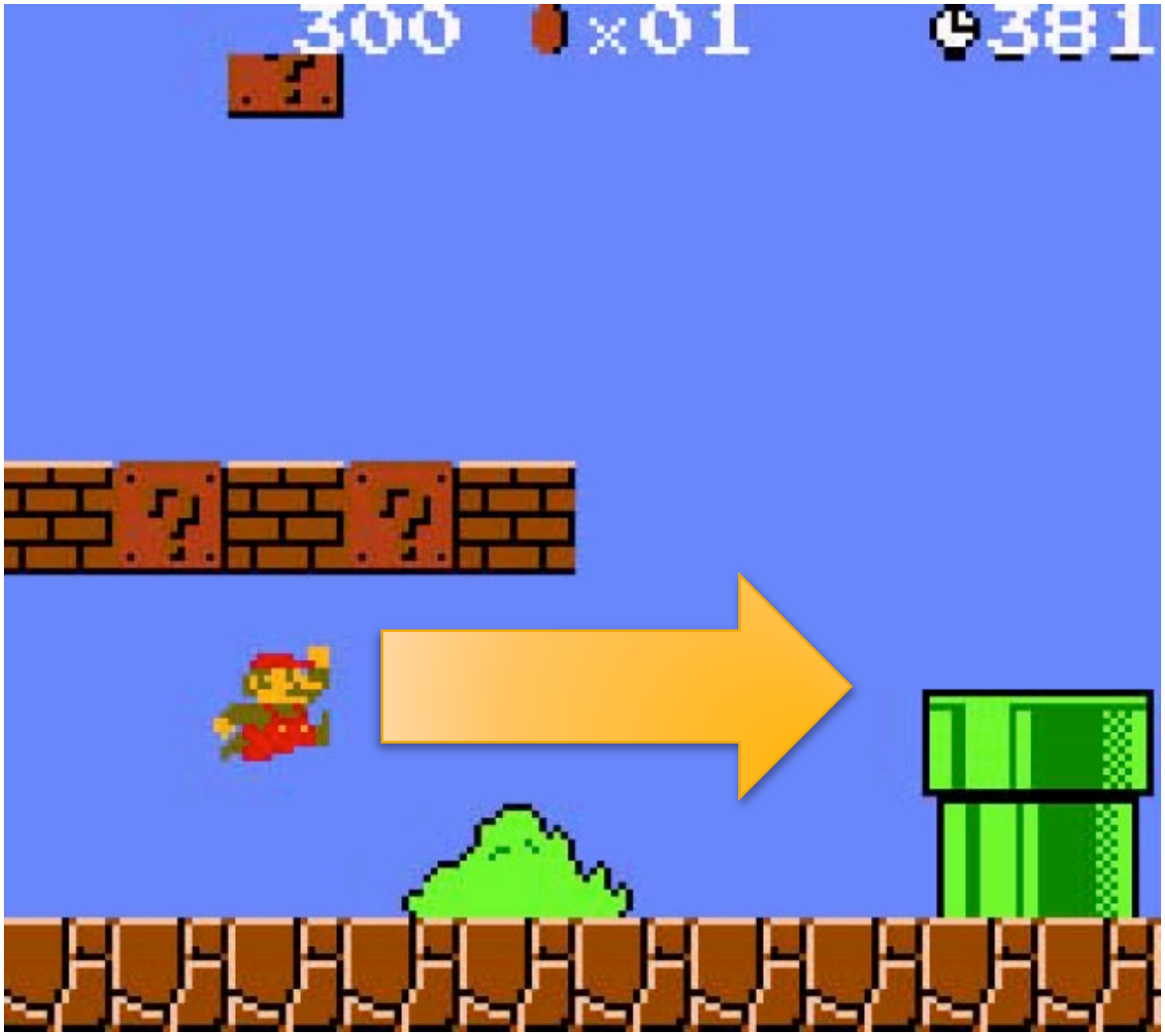
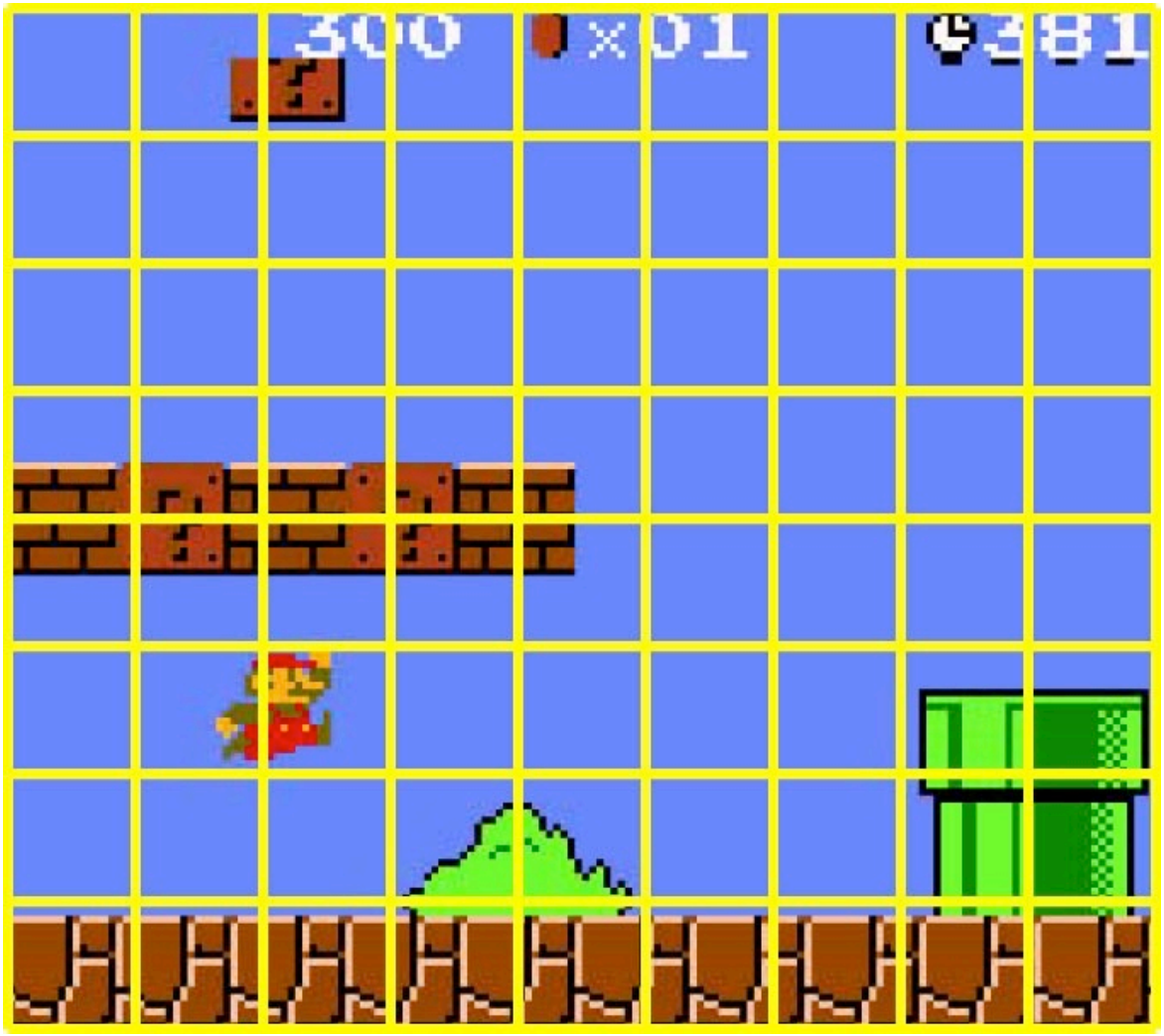
Recording Movement



Recall: Discretizing Space



Recall: Discretizing Space

Identifying Key Events

Identifying Key Events

Recording Movement

walk_right() walk_right() walk_right() walk_right()
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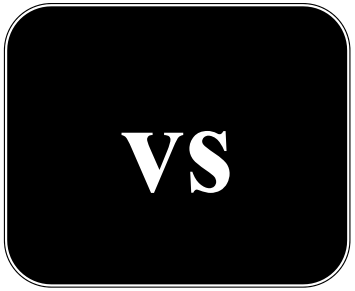
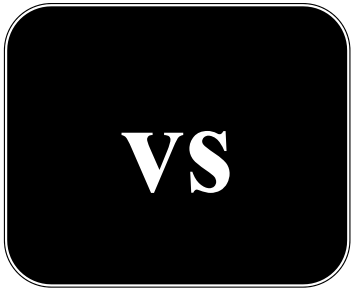


walk_right(3 seconds)

Recording Movement

player_at(1, 1) player_at(1, 1) player_at(1, 1)
player_at(1, 1) player_at(2, 1) player_at(3, 1)



player_at(1, 1) player_at(2, 1) player_at(3, 1)

Recording Health

Player health dropped to 99%

Player health dropped to 98%

Player health dropped to 97%

Player health dropped to 96%

Player health dropped to 80%

Player health dropped to 60%

Player health dropped to 40%

Player health dropped to 20%

Player health dropped to 10%

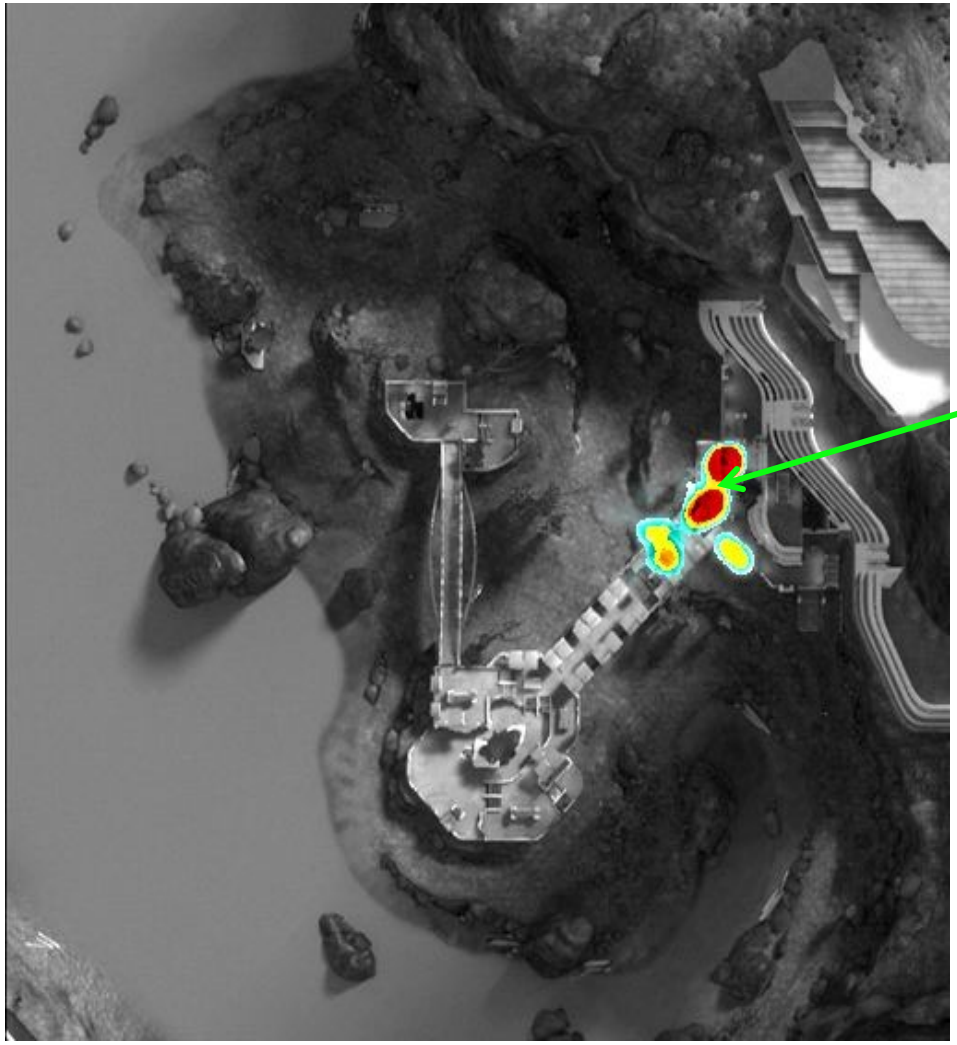
Player health dropped to 5%

VS

Spatial Analytics

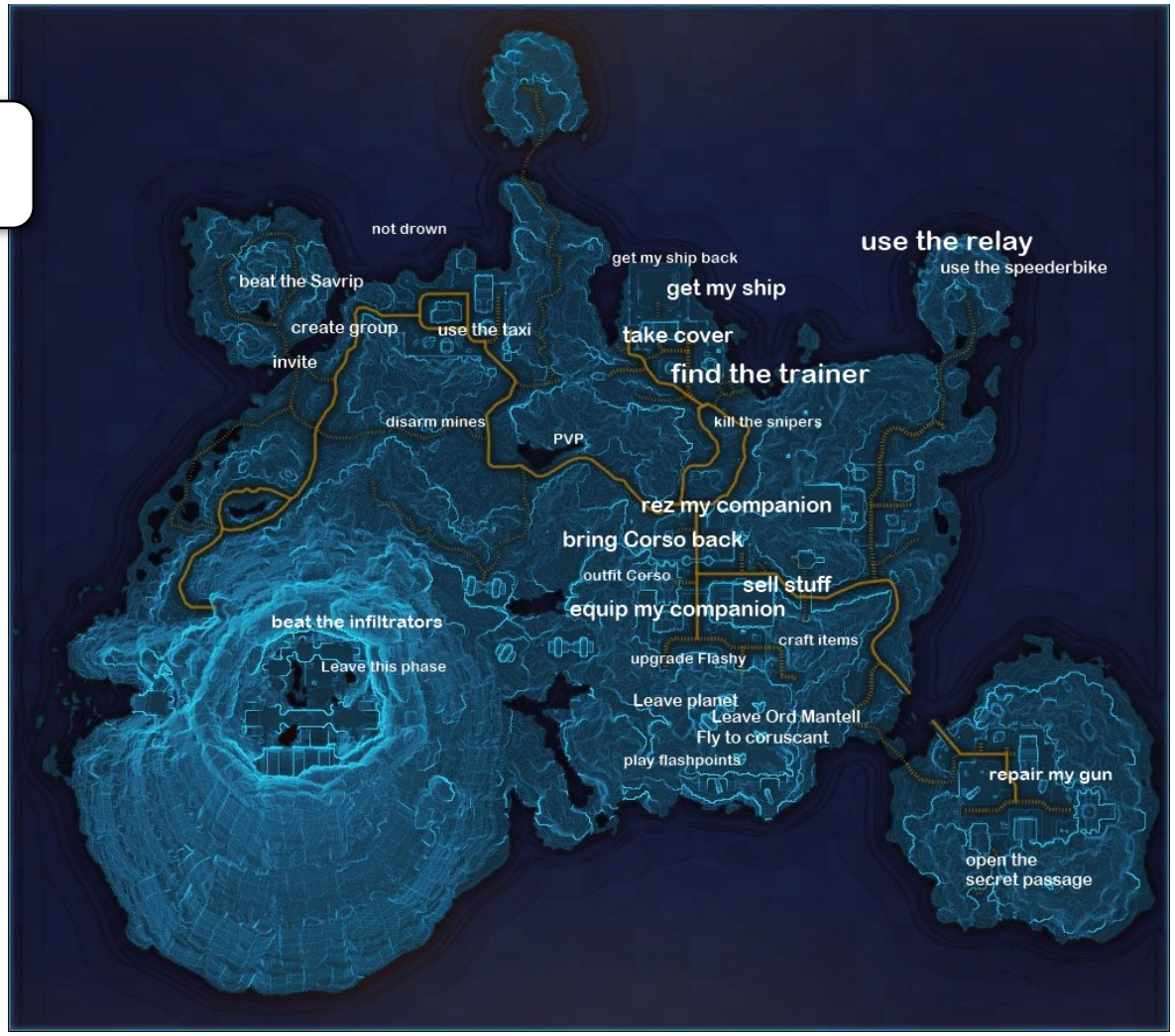
- Needed for anything that depends on **location**
  - Identify where players are having difficulty
  - Critical for MMOs, large and persistent worlds
  - **Example**: player death heat maps
- Visualization is much, much harder
  - Spatial representation is particular to your game
  - There are no simple, existing solutions
  - Companies create their own custom tools

Spatial Data: Heatmaps



SWTOR Example: Chat Logs

Filter on:
How do I…

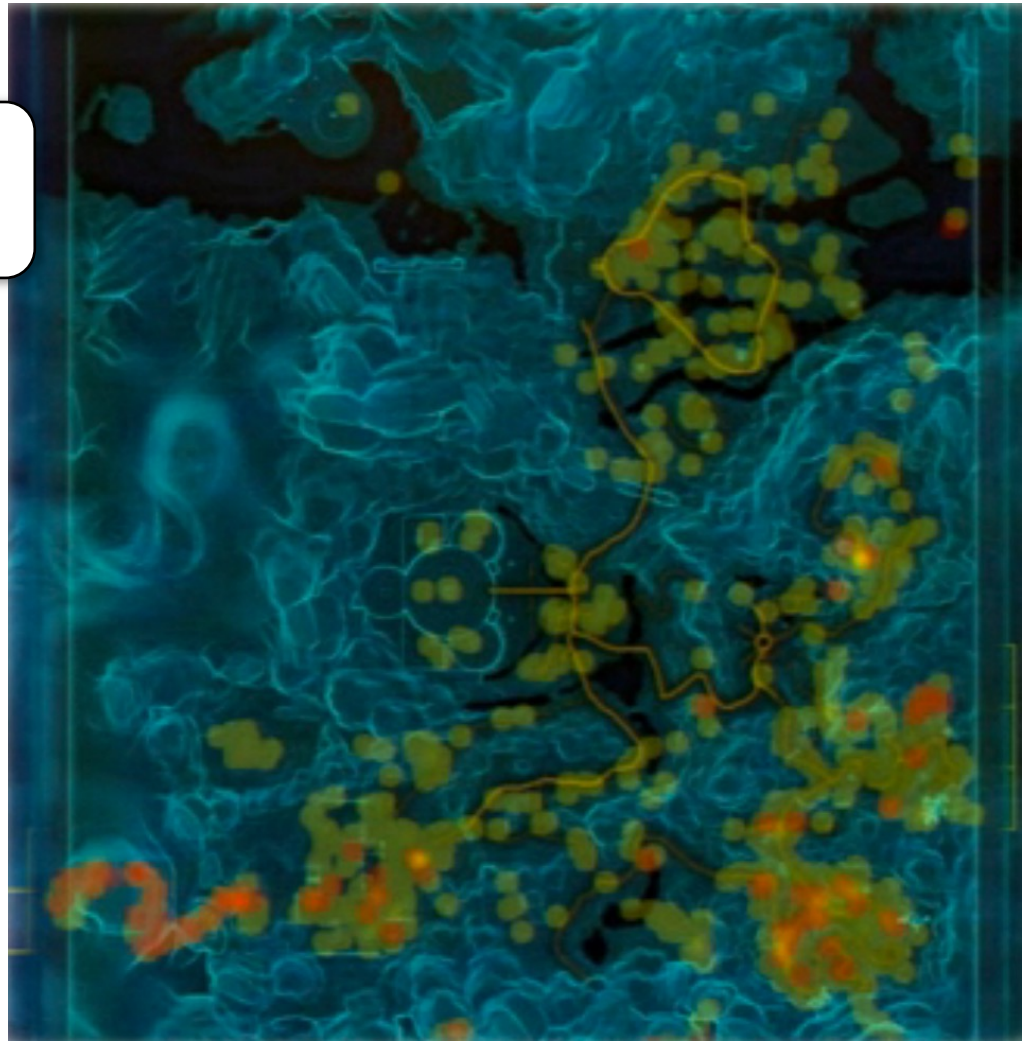


SWTOR Example: Chat Logs

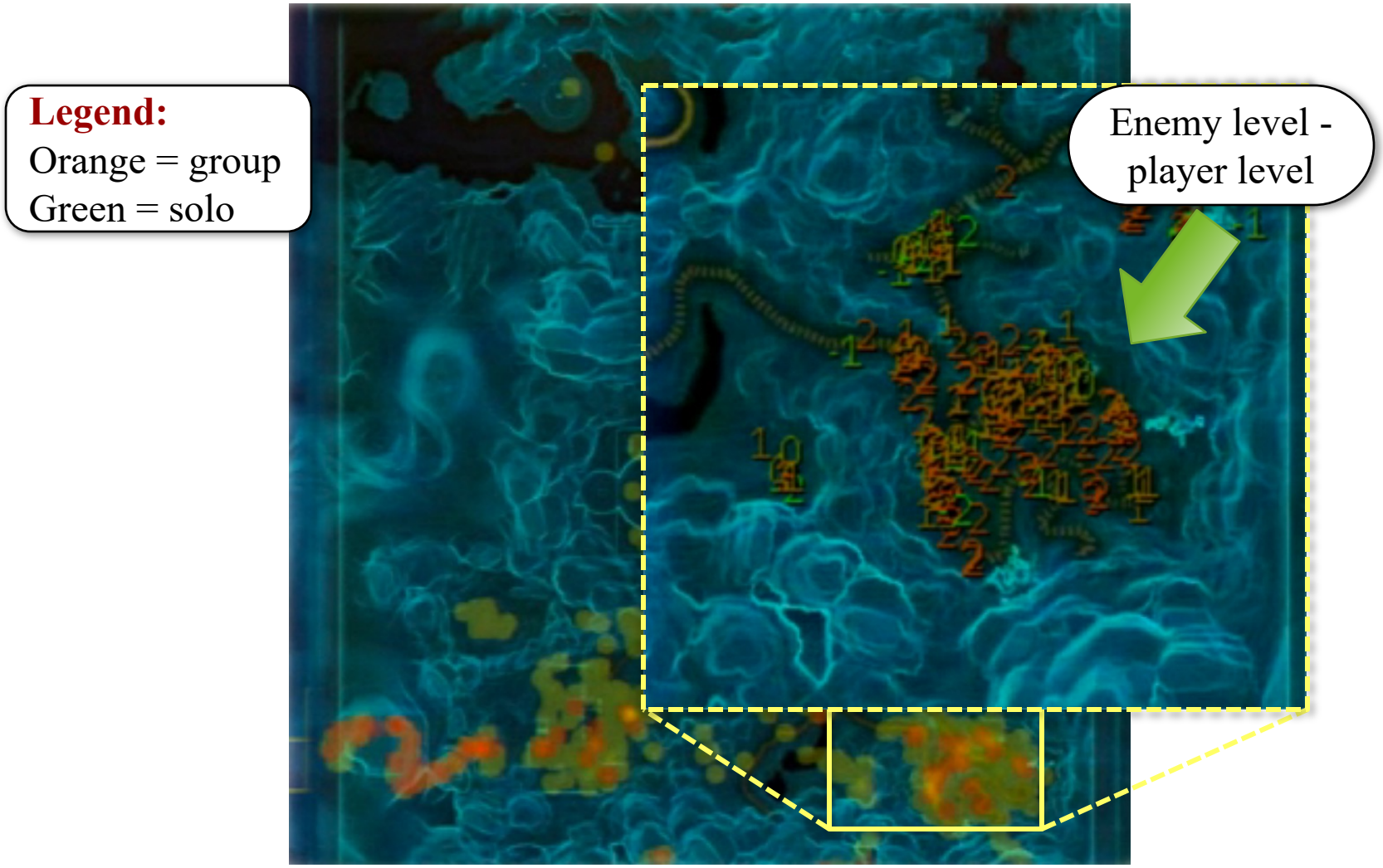
Filter on:
Bug, Broken

SWTOR Example: Player Deaths

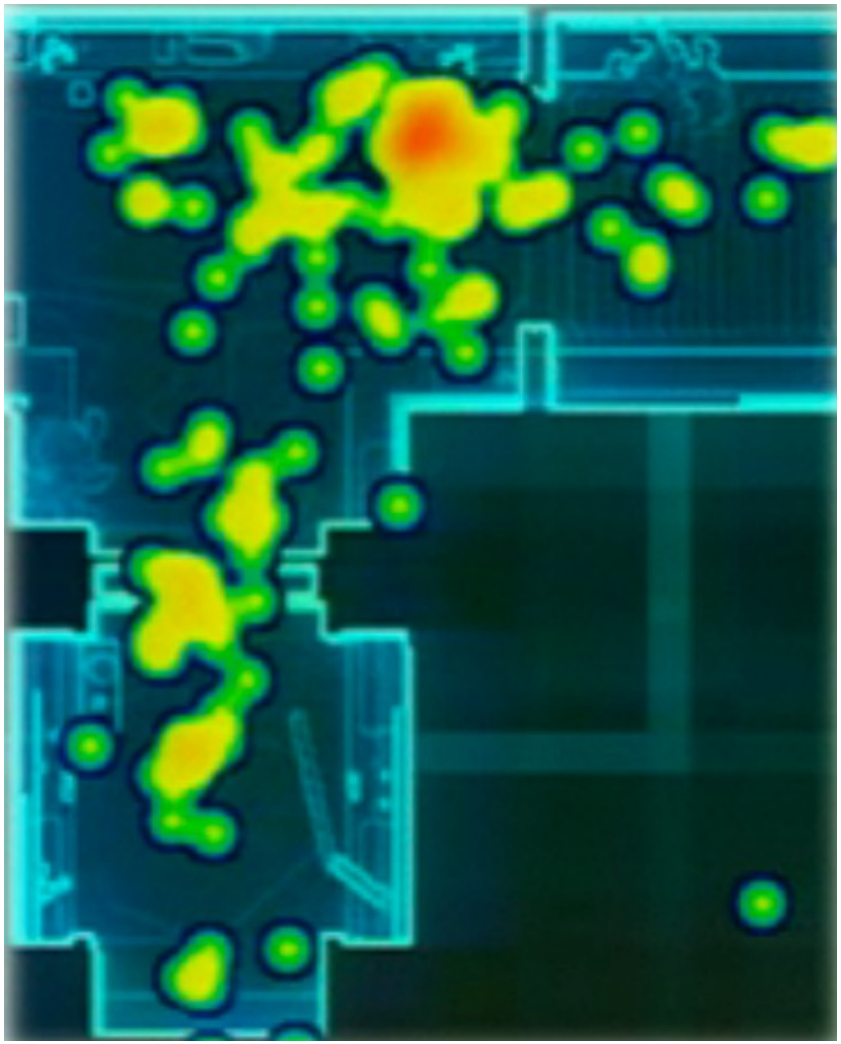
Legend:
Orange = group
Green = solo

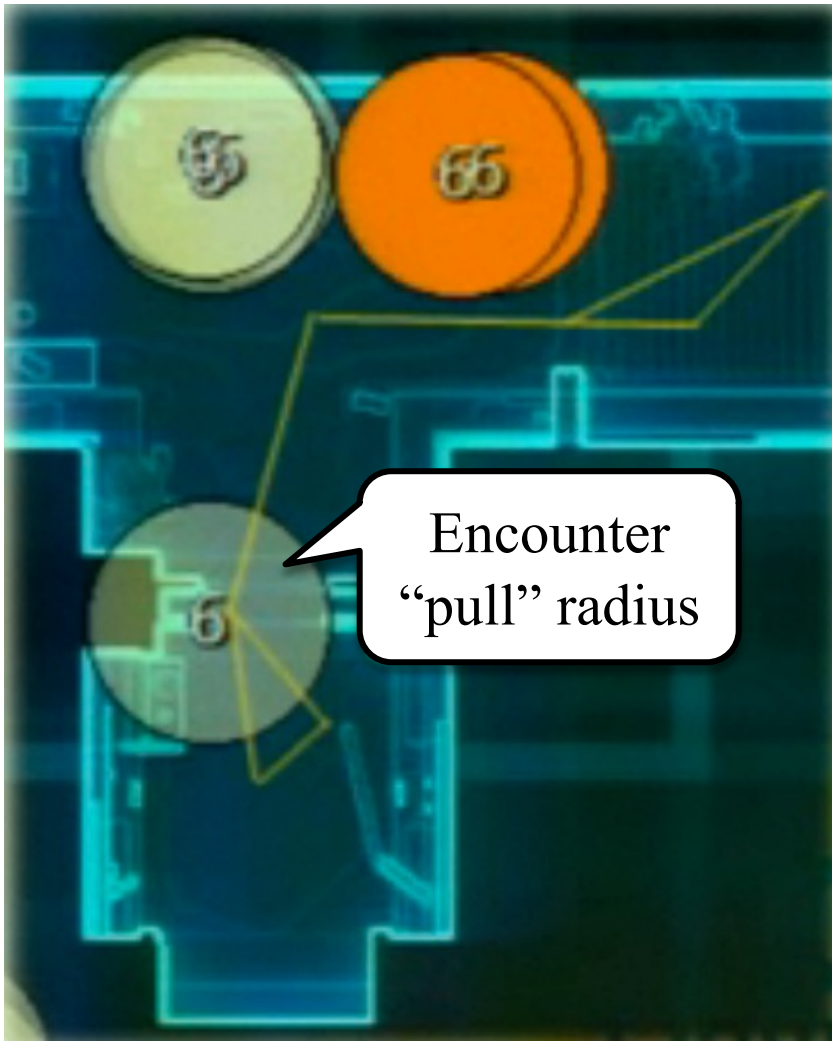


SWTOR Example: Player Deaths



SWOTOR Example: Patrol Paths

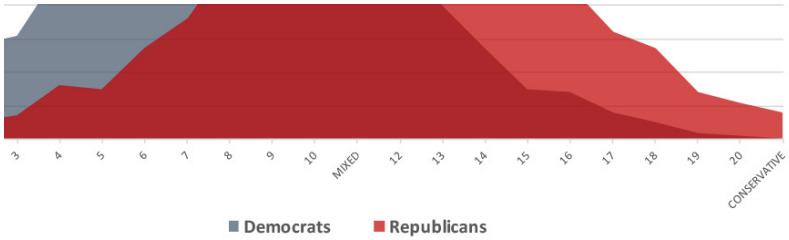


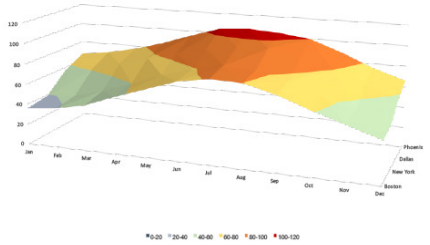


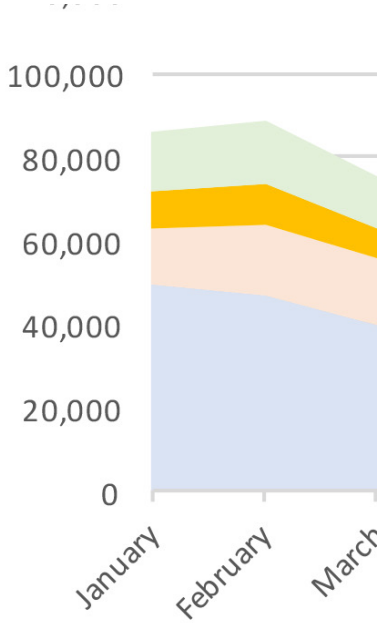
Challenges of Spatial Data

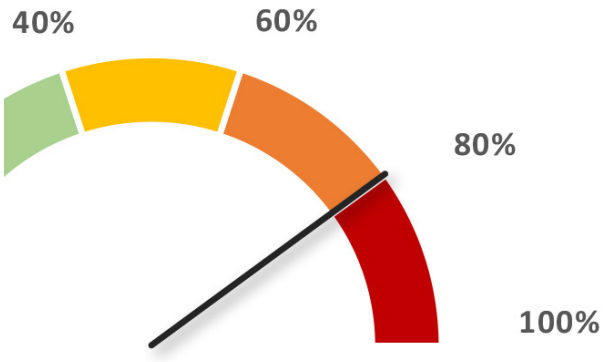
- There are many 3rd party data analysis tools
  - Data analysis is a major part of running a business
  - Business tools work well for player analysis
- But spatial data is very *game specific*
  - Superimposed onto your game visuals
  - Must integrate into your rendering engine
  - Limited to high-end game companies
- What can an **Indie developer** do?

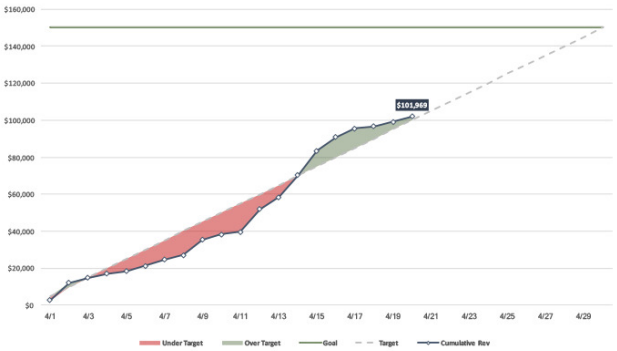
The Simplest Option: *Excel*

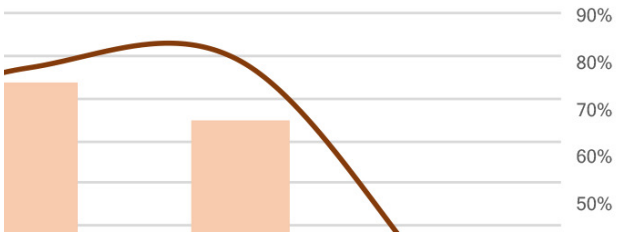


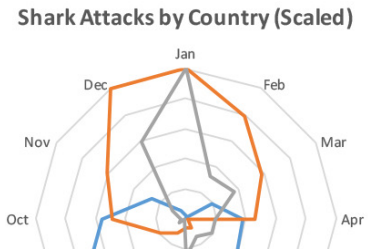


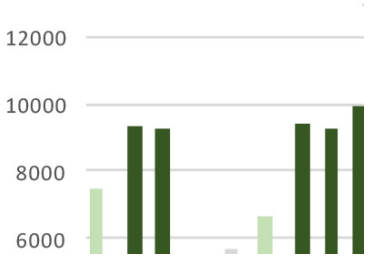




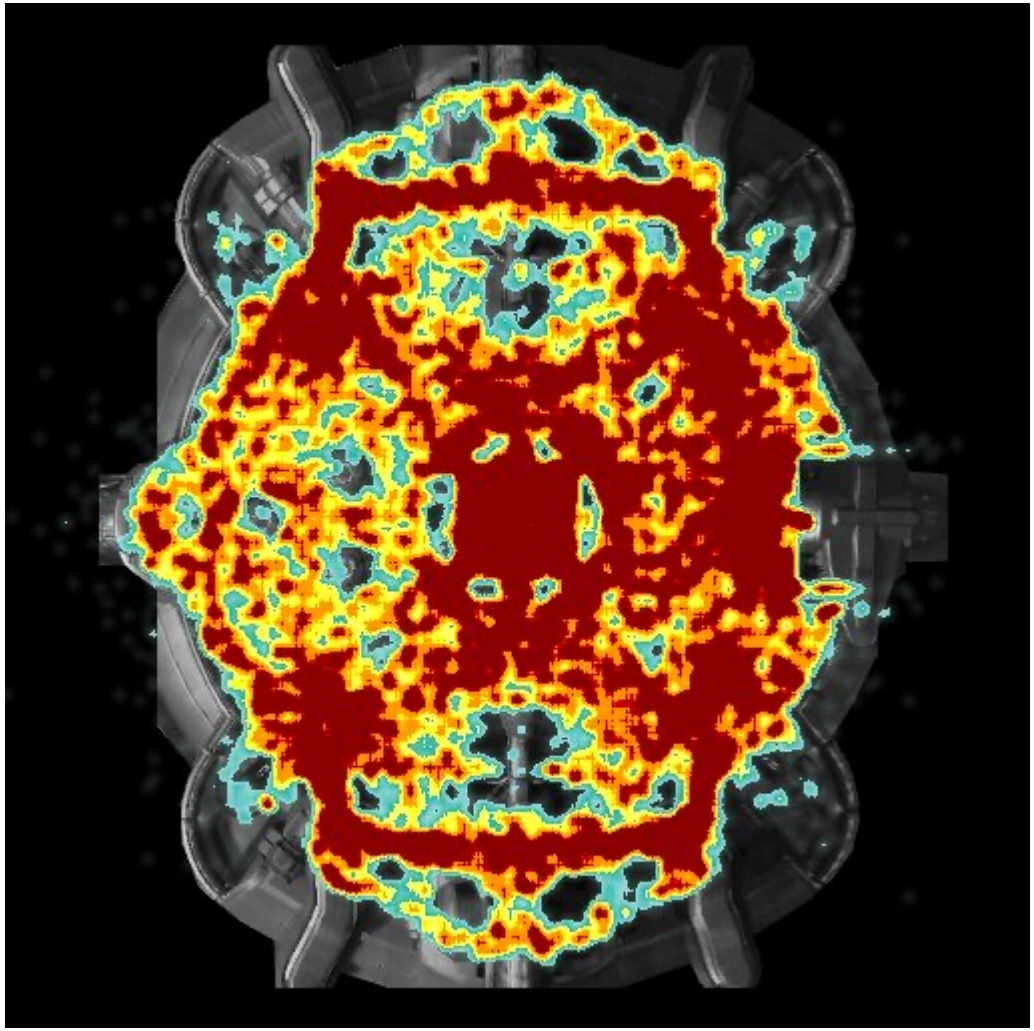








Example: Heat Maps



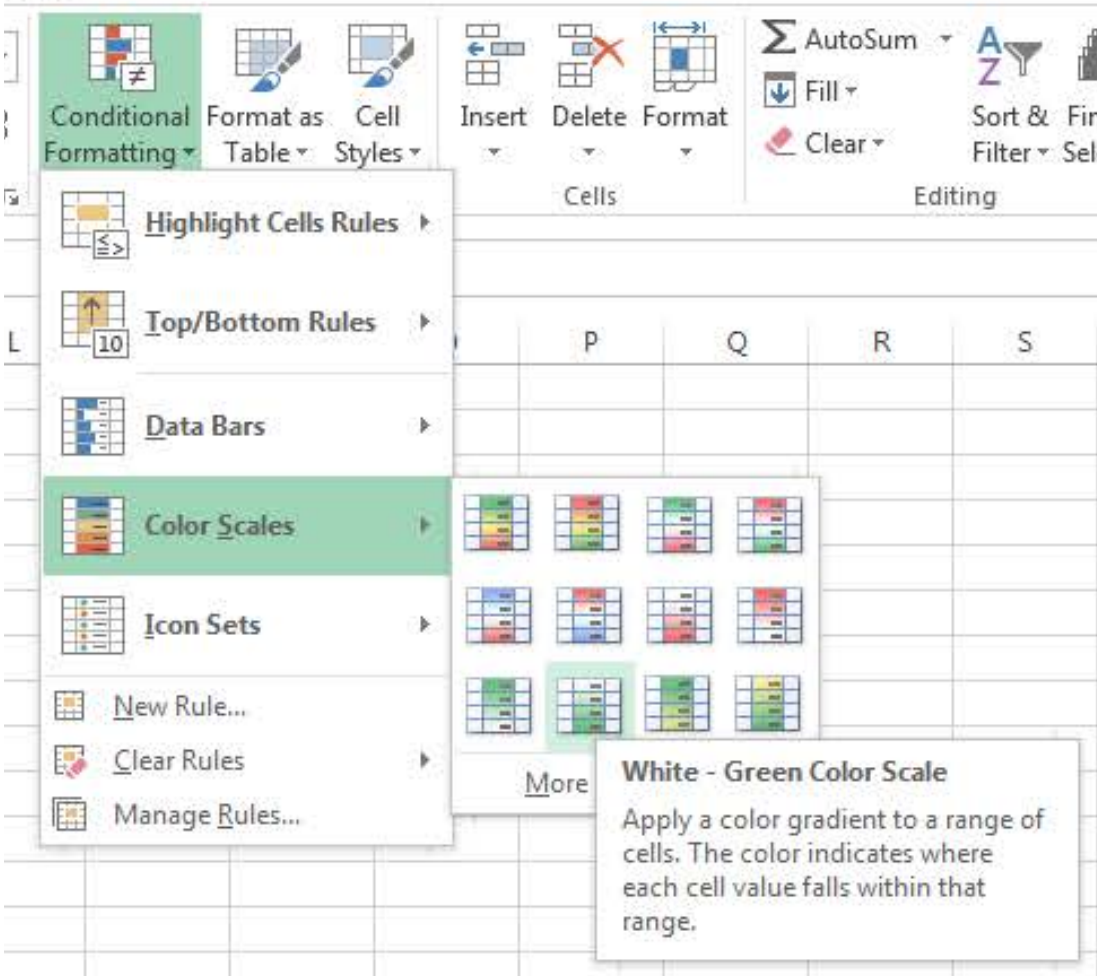
A Simple Heat Map

Death	X	Y
1	1	1
2	2	1
3	1	2
4	1	1
5	3	1
6	4	4
7	4	3

	1	2	3	4
1	2	1	0	0
2	1	0	0	0
3	1	0	0	0
4	0	0	1	1

= COUNTIFS(B2:B8, "="&E2,C2:C8, "="&F1)

Conditional Formatting



A Simple Heat Map

Death	X	Y			1	2	3	4
1	1	1		1	2	1	0	0
2	2	1		2	1	0	0	0
3	1	2		3	1	0	0	0
4	1	1		4	0	0	1	1
5	3	1						
6	4	4						
7	4	3						

Some Final Warnings

- Be careful with how you interpret data
  - Data is good at highlighting correlations
  - But you want to understand causation
- Trust your **design sense** first
  - If data contradicts, try to understand why
  - Do not jump to easy answers
  - Understand not everyone will be happy
- Not unlike working with playtest results

Example: *Slay the Spire*

- The card *Madness*
  - Common in "winning" decks
  - Does this mean it is warping?
- It only appears in Act 3
  - Comes from a special event
  - Players that died never saw it
  - Was an indication of winning

Correlation
≠
Causation

Summary

- Gameplay analytics are increasingly important
  - Often driven by your business model
  - Crucial for monetized/free-to-play games
  - Skill heavily in demand at most game companies
- Often break data into different types
  - **Player analytics**: activity of a player over time
  - **Gameplay analytics**: game economy and balance
  - **Spatial analytics**: Locality of behavior in game