



MIKE AMBINDER, PhD  
VALVE

DATA TO DRIVE DECISION-MAKING



# HOW AND WHY VALVE USES DATA TO DRIVE THE CHOICES WE MAKE

# Data to Drive Decision-Making

- Decision-Making at Valve
- Introduction to experimental design
- Data collection/analysis infrastructure
- Examples
  - Playtesting (L4D)
  - DOTA 2
  - CS:GO







# DECISION-MAKING AT VALVE

# Decision-Making at Valve

- No formal management structure
- Decision-making is a meritocracy
- All data is available to every employee
- We just want to make the best decisions possible.
- We don't want to rely on 'instinct' → it is fallible

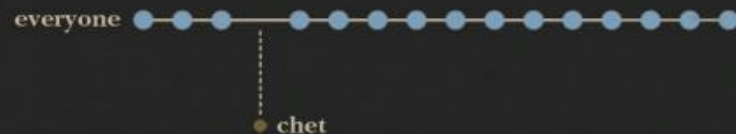
# VALVE ORGANIZATIONAL CHARTS

(AS ENVISIONED BY EMPLOYEES)

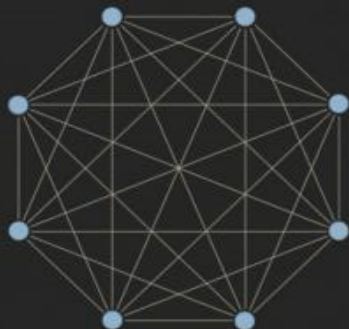
Diag. 1



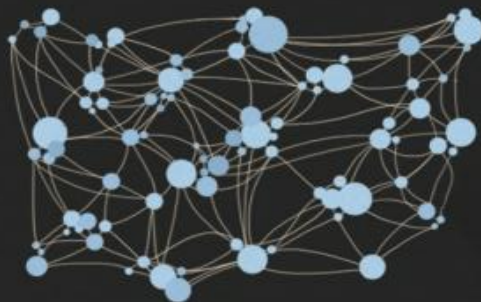
Diag. 2



Diag. 3



Diag. 4



Diag. 5



\* "I'm the noob, coffee anyone?...Hello?"



# Decision-Making



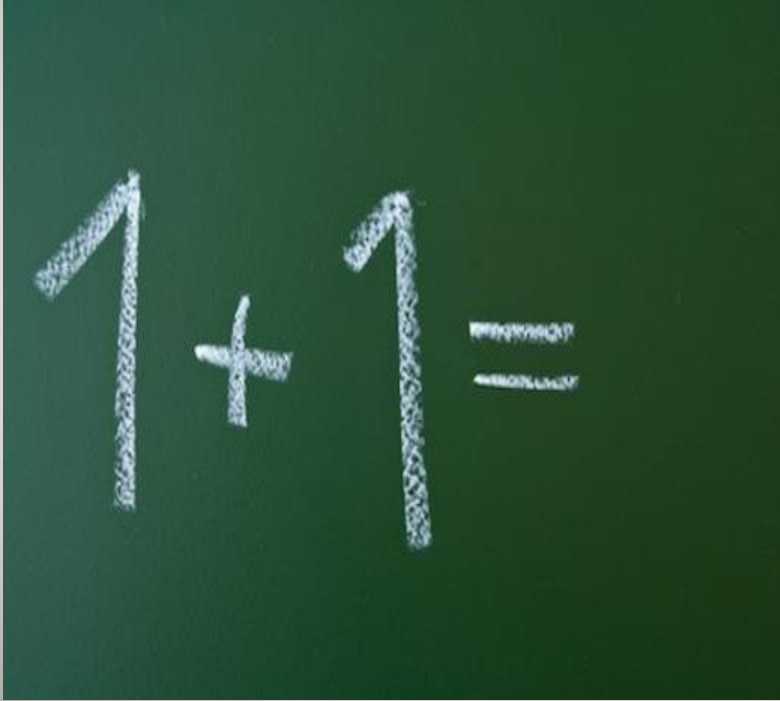
- Explicit
- Data-driven
- Theory-driven
- Measurable Outcomes
- Iterative



# Explicit

- What problem are you trying to solve?
- Define terminology/constructs/problem space
- Ask the 'second' question
- Force yourself to be specific
- Force yourself to be precise

# Data-Driven



- What do we know about the problem?
- What do we need to know before we decide?
- What do we still not know after we decide?

# Theory-Driven

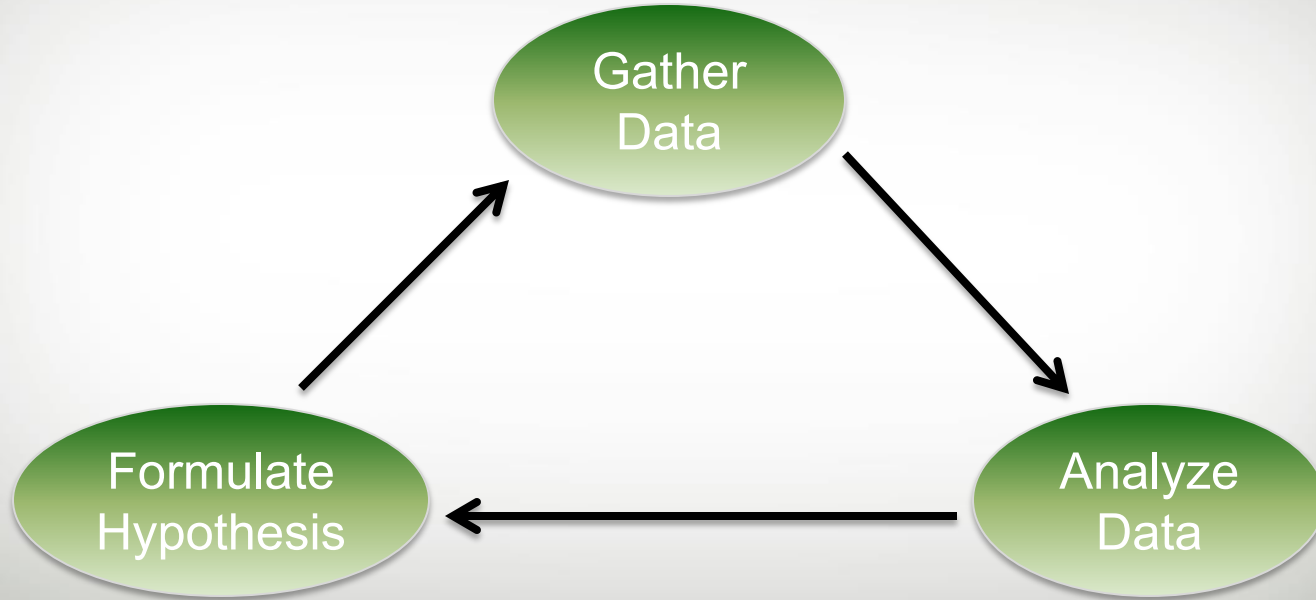
- What does the data mean?
  - Is it consistent with expectations?
  - Is it reliable?
- Model derived from prior experience/analysis
- Coherent narrative
- Prove a hypothesis right (or wrong)
- Want result AND explanation

# Measureable Outcomes

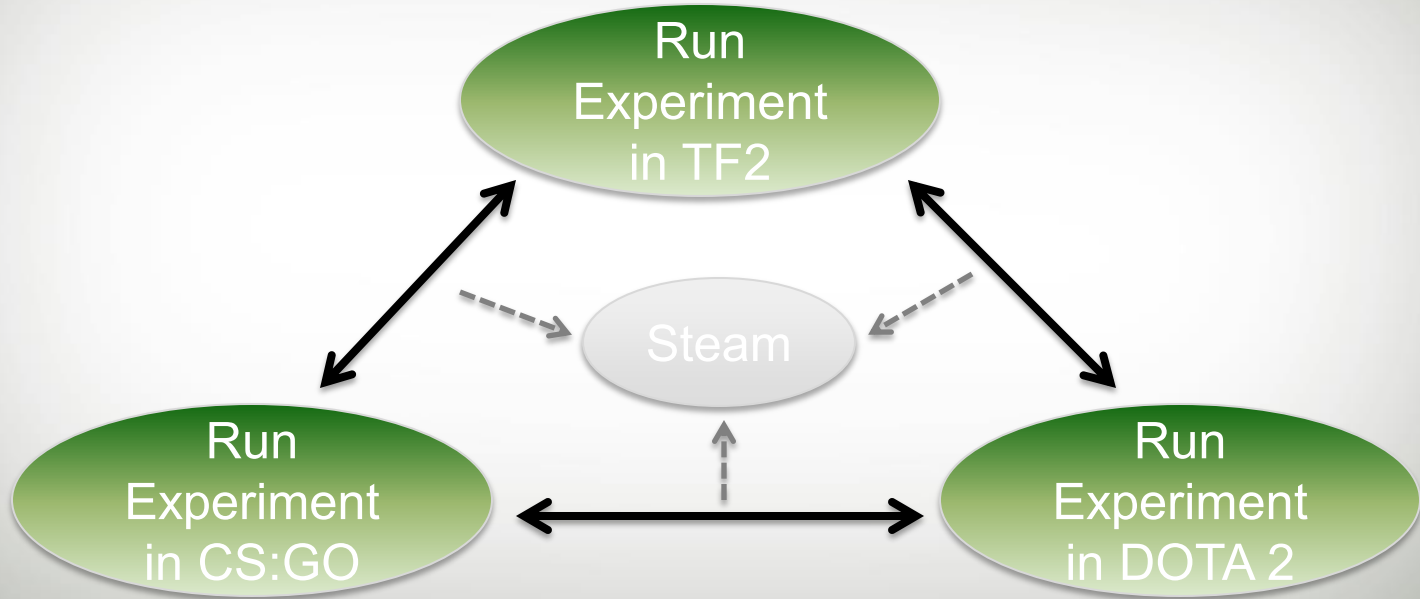
- Define 'Success'
- How will we know we made the right choice?
- Know the 'outcome' of your decision



# Iterative

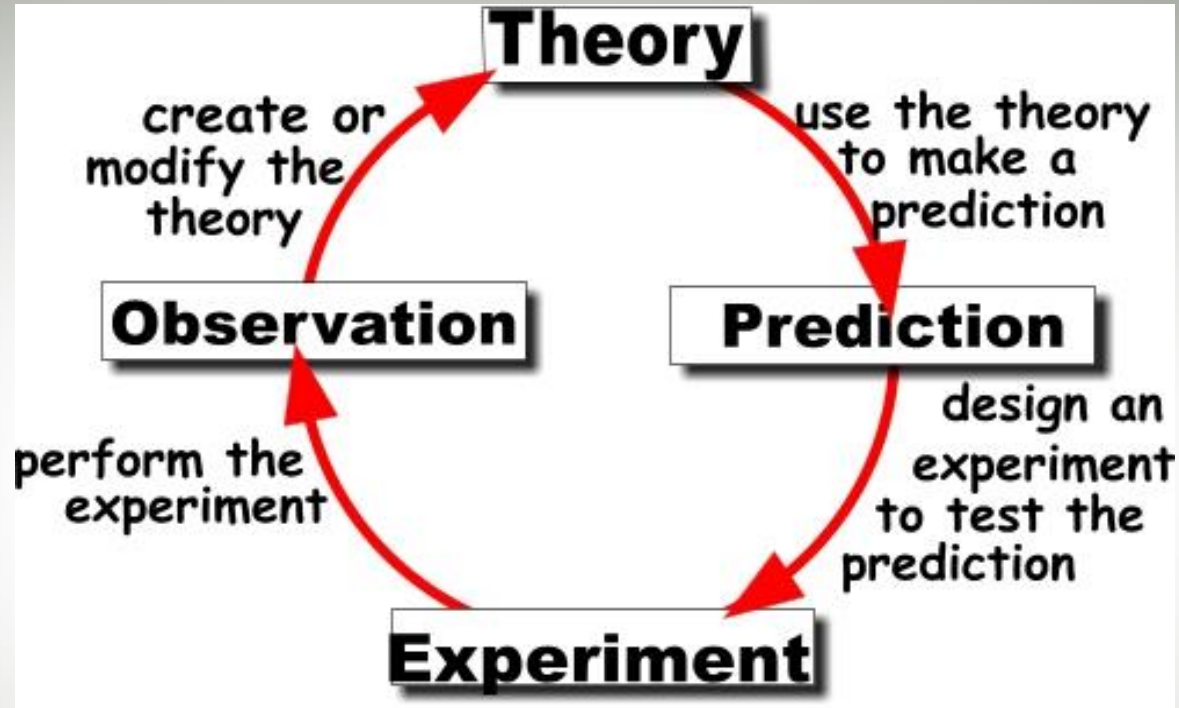


# Iterative



**If it can be destroyed by the truth, it  
deserves to be destroyed by the truth.  
– Carl Sagan**

INTRODUCTION TO EXPERIMENTAL DESIGN



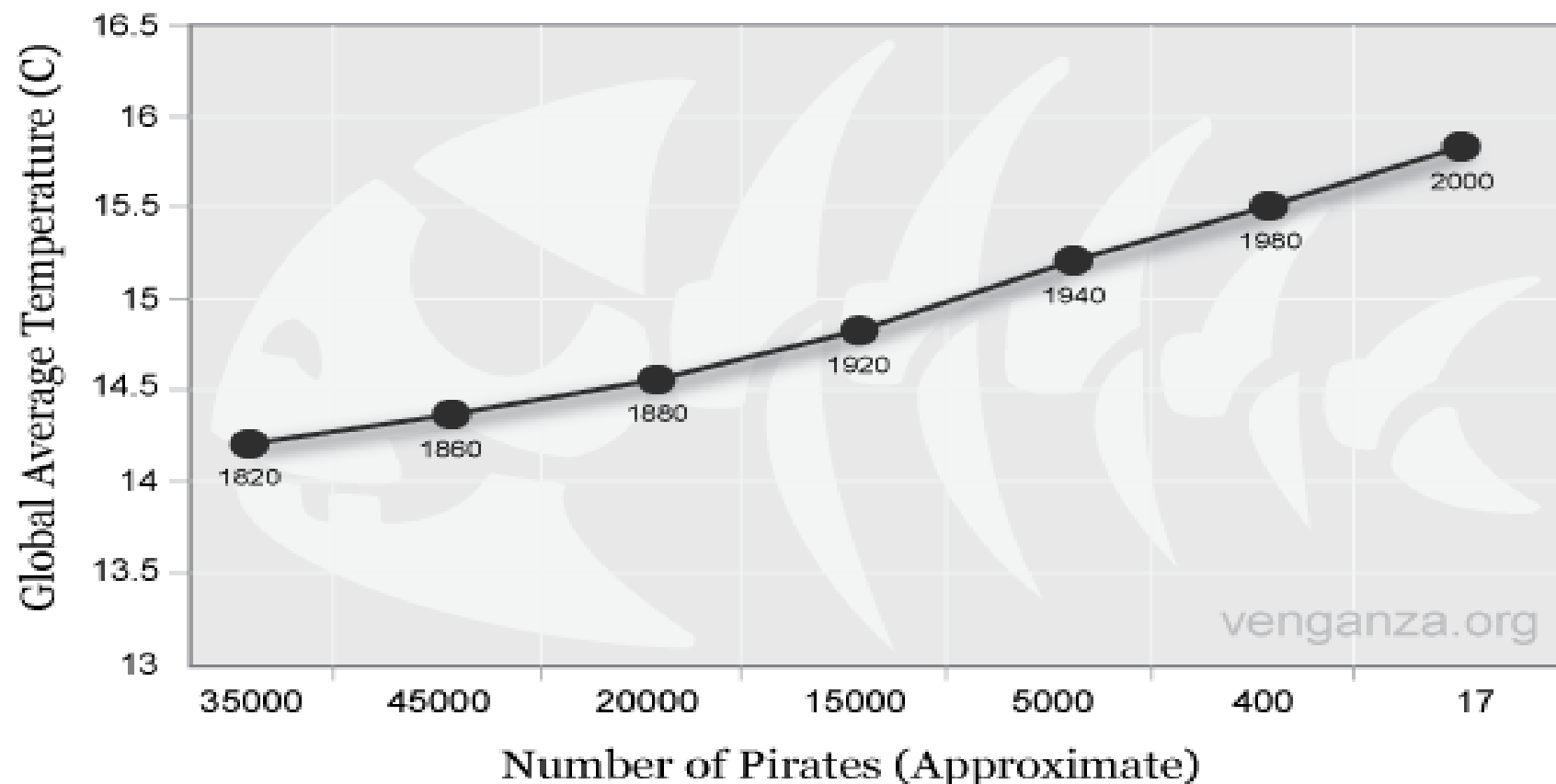
## THE SCIENTIFIC METHOD



# Experimental Design

- Observational
  - Retrospective vs. Prospective
  - Correlational not causal
- Experiment
  - Control Condition and Experimental Condition
  - Account for confounding variables
  - Measure variable of interest

# Global Average Temperature Vs. Number of Pirates



# Experimental Design

- What have we learned?
- What biases are present?
- How are future experiments informed?
- What other hypotheses need to be ruled out?
- What should we do next?



# DATA COLLECTION/ANALYSIS INFRASTRUCTURE



# Valve Data Collection

- Record lots and lots (and lots) of user behavior
- If we're not recording it, we'll start recording it
- Define questions first, then schema
- Collection → Analysis → Communication

# Data Collection - Games

- OGS – Operational Game Stats
- Platform for recording gameplay metrics
- Kills, Deaths, Hero Selection, In-Game Purchases, Matchmaking wait times, Bullet trajectories, Friends in Party, Low-Priority Penalties, etc.



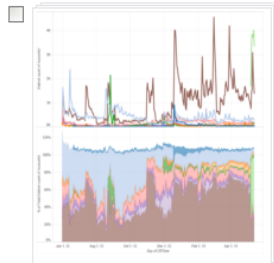
# Data Collection - Games

- Organizational schemas defined for each game
- Data sent at relevant intervals
- Daily, Monthly, Lifetime Rollups, Views, Aggregations

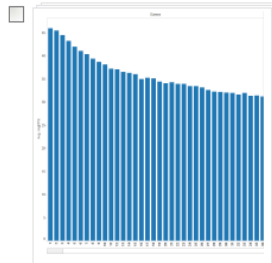


# ValveStats

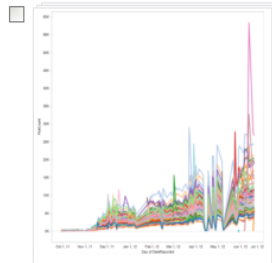
Account First Purchases



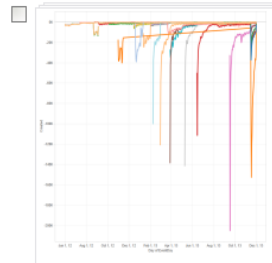
ChineseUsersPerf



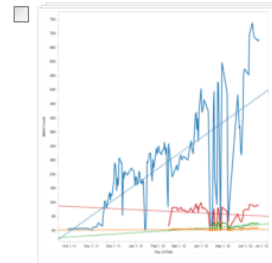
Dota 2 Heroes



Dota 2 Item Balance



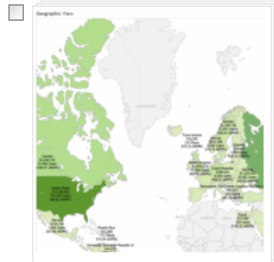
Dota 2 Matches



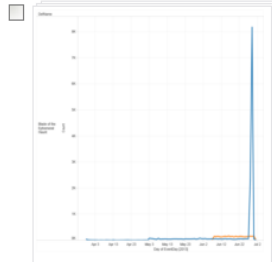
Dota 2 Perf



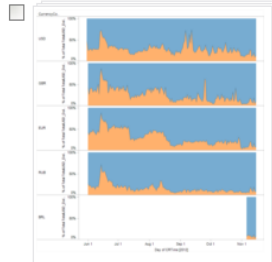
DOTA Geographic Purchases



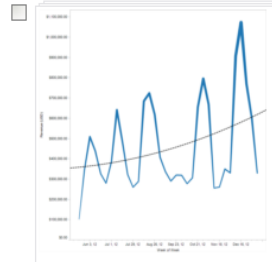
Dota Item Purchases / Drops



Dota Sales by Currency



Dota Weekly





# Data Collection - Steam

- Steam Database – Raw data
- SteamStats Database – Analysis/Summary of Raw Data
- Record all relevant data about Steam user behavior

## Server Stats

[Steam3 Content Servers](#)  
[Server Test Results](#)

## Content System

[Current Traffic Map](#)  
[Aggregate CS Statistics](#)  
[CDN Traffic](#)  
[Content Download](#)  
[Download Rates](#)

## Regions

[North America](#)  
[South America](#)  
[Western Europe](#)  
[Eastern Europe](#)  
[Russian territories](#)  
[Oceania](#)  
[Asia](#)  
[South East Asia](#)  
[EU](#)  
[EEA](#)

## Countries

[Afghanistan](#)  
[United States](#)  
[Aland Islands](#)  
[Albania](#)  
[Algeria](#)

## Reports

[Affiliates](#)  
[Best days](#)  
[Friend Blocking](#)  
[Cached Credit Cards](#)  
[Crashes](#)  
[Cloud Stats](#)  
[Credential Stats](#)  
[Community Stats](#)  
[Coupons](#)  
[Free-2-Plays](#)  
[Facebook](#)  
[Gifts](#)  
[Hardware survey](#)  
[Media views](#)  
[New users](#)  
[Oxcart apps](#)  
[Payment methods](#)  
[Payment analysis](#)  
[Player numbers](#)  
[Playtime stats](#)  
[Economy Trades](#)  
[Purchase failures](#)  
[Revoked Legacy Keys](#)  
[Sales by year](#)  
[Non-Steam games \(shortcuts\)](#)  
[Steam Apps and Subscriptions](#)  
[Steam Support](#)  
[Support Tickets](#)  
[SteamGuard Stats](#)  
[Steamstats query performance](#)  
[Steamworks retail report](#)  
[Thirdparty CD Keys](#)  
[VAC Ban Report](#)  
[Wallet stats](#)

## STEAMWORKS PRODUCT DATA

[Home](#) | [Games](#) | [Packages](#) | [Regions](#) | [Users](#) | [Players](#) | [Support](#) | [Economy](#)

### Lifetime Overview

Revenue  
Units  
First Sale Date  
Last Sale Date  
Selling For  
Peak Concurrent Users (PCU)  
\$ per Day per PCU  
Unique Users  
Unique Purchasers  
Conversion Rate  
Avg Rev per User (ARPU)  
Avg Rev per Paying User (ARPPU)  
Avg Rev per Day (ARPD)

Lifetime Steam revenue  
Lifetime Steam units  
Lifetime Retail units  
Lifetime total units  
Lifetime total DLC units  
Current players  
Median time played  
Unique users  
New users

New user total \$ spent  
New user average \$ spent  
Publisher  
Demo version


#### Top games by current player count

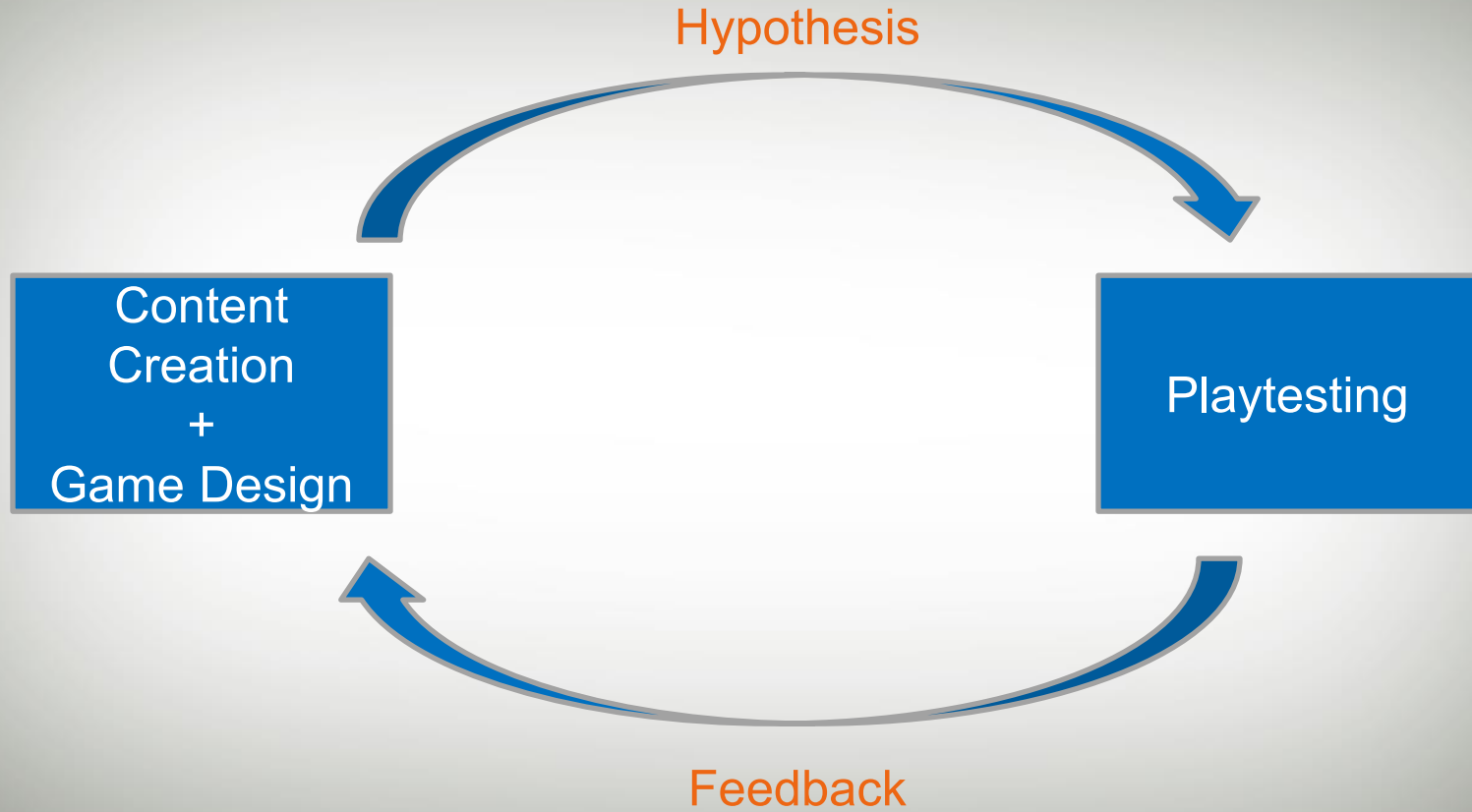
Current Players	Peak Today	Game
393,167	555,387	Dota 2
87,910	94,008	Counter-Strike: Global Offensive
66,945	71,702	Football Manager 2014
52,207	57,089	Team Fortress 2
46,741	48,406	The Elder Scrolls V: Skyrim
42,542	44,481	Sid Meier's Civilization V
37,424	39,716	Counter-Strike
32,977	33,250	DayZ
27,911	28,715	Rust
27,172	33,125	Garry's Mod



# PLAYTESTING

# Valve's Game Design Process

- Goal is a game that makes customers happy →
- Game designs are hypotheses →
- Playtests are experiments →
- Evaluate designs based off playtest results →
- Repeat 



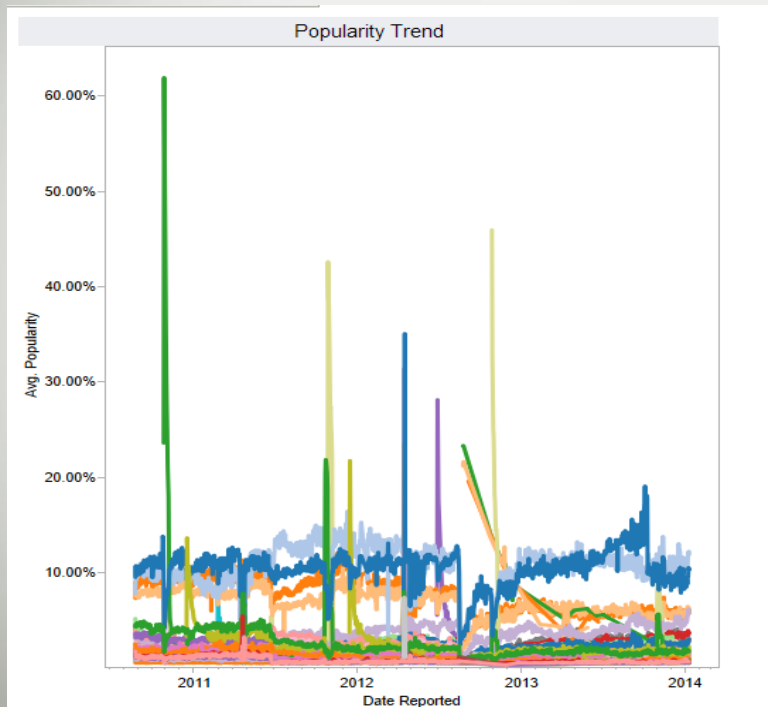
# Playtest Methodologies



- Traditional
  - Direct Observation
  - Verbal Reports
  - Q&As



# Playtest Methodologies



- Technical
  - Stat Collection/Data Analysis
  - Design Experiments
  - Surveys
  - Physiological Measurements (Heart Rate, Eyetracking, etc.)



LEFT 4 DEAD

# Enabling Cooperation

- Coop Game where competing gets you killed
- Initial playtests were not as enjoyable as hoped
- Initial playtests were not as cooperative as hoped
  - Players letting their teammates die
  - Ignoring cries for help

# Enabling Cooperation

- Explicit: Players letting teammates die
- Data-Driven: Surveys, Q&As, high death rates
- Theory-Driven: Lack awareness of teammate location
- Measurements: Surveys, Q&As, death rates
- **Iterative:**

Hypothesis: Give better visual cues to teammate location



QUARANTINE  
CONTAGIOUS DISEASE  
NO ONE MAY ENTER  
THIS BUILDING WITHOUT  
THE CIVIL DEFENSE AND  
DEFENSE AGENCY  
VIOLATORS WILL BE  
PROSECUTED  
VCEDA

Bill

  
50 480

  
15











QUARANTINE  
CONTAGIOUS DISEASE  
NO ONE MAY ENTER OR LEAVE  
THIS BUILDING BY ORDER OF  
THE CIVIL EMERGENCY AND  
DEFENSE AGENCY  
TRESPASSERS WILL BE  
PROSECUTED  
YCEDA

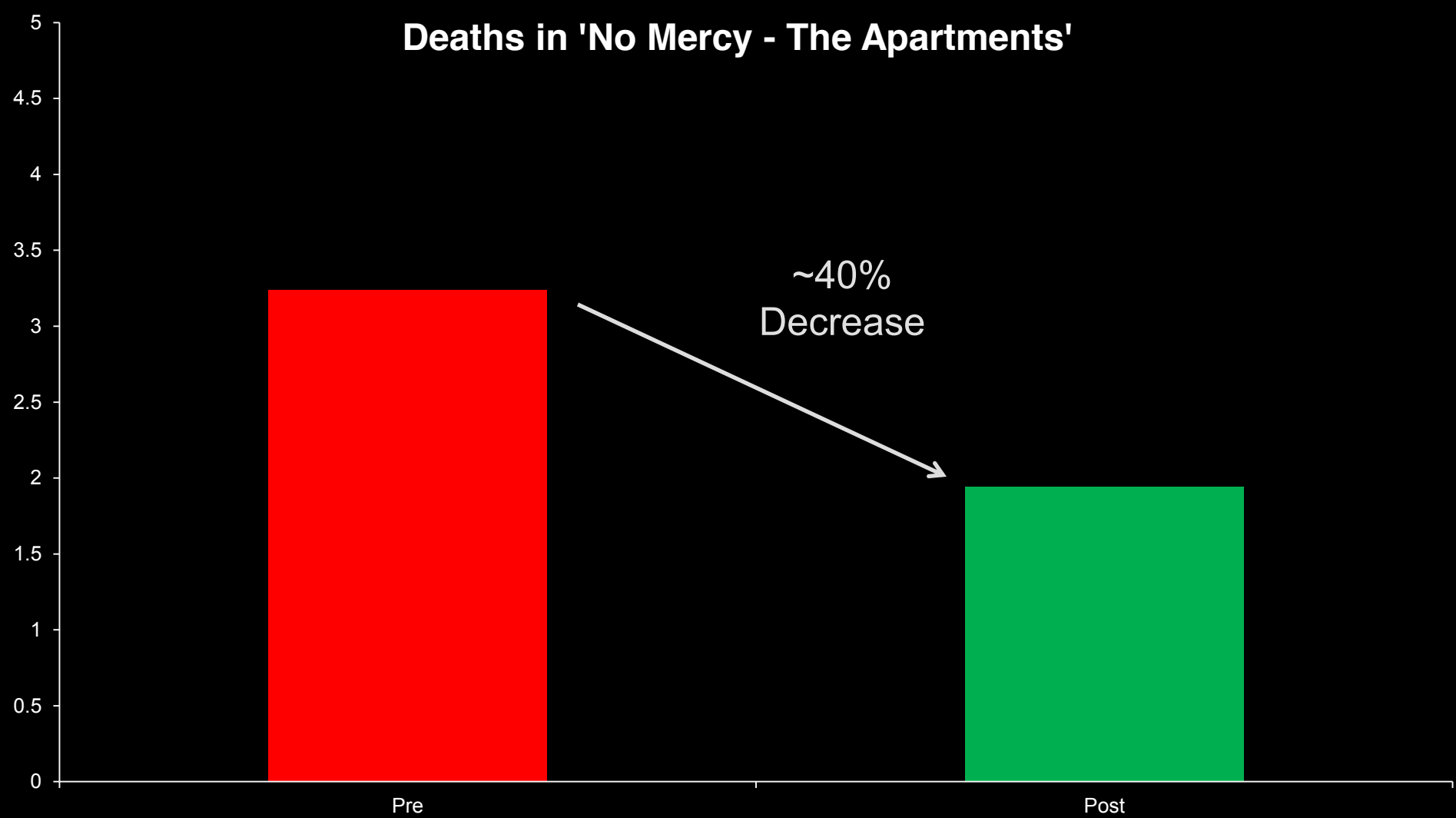
50 480

15





# Deaths in 'No Mercy - The Apartments'



# Results

- Survey ratings of enjoyment/cooperation increased
- Anecdotal responses decreased
- Deaths decreased

# Enabling Cooperation

- Explicit: Players letting teammates die
- Data-Driven: Surveys, Q&As, high death rates
- Theory-Driven: Lack awareness of teammate location
- Measurements: Surveys, Q&As, death rates
- Iterative: Where else can visual cues aid gameplay?



DOTA 2

492



[ALLIES] **Binder**: Hello, good sir, I am new to DOTA. Any advice for playing Helicopter Man?



[ALLIES] **Piggles ULTRAPRO**: Greetings DOTA citizen! I relish the opportunity to share my expertise with a new player!



[ALLIES] **Binder**: Fantastic! In others news, I have recently died.



[ALLIES] **Piggles ULTRAPRO**: Not a problem, friend! I will prepare some rational and constructive feedback to help you learn the game.



Say (TEAM)

# Improve Player Communication

- Explicit: Reduce negative communication
- Data-Driven: Chat, reports, forums, emails, quitting
- Theory-Driven: No feedback loop to punish negativity
- Measurements: Chat, reports, ban rates, recidivism
- Iterative: Will this work in TF2? Do these systems scale?

Hypothesis: Automating communication bans will reduce negativity in-game



## REPORT PLAYER

m2

?

Select a category



Communication Abuse

They were abusive over a communication channel (text or voice)

More information:

using offensive language

CANCEL

Reports Remaining: 2

Total reports submitted: 0

SUBMIT

## THANK YOU

We've recently taken action against one or more players you've previously reported for bad conduct. You have received an additional report submission to use. Thanks for your help in making the Dota 2 community a friendlier place.

OK

# Results

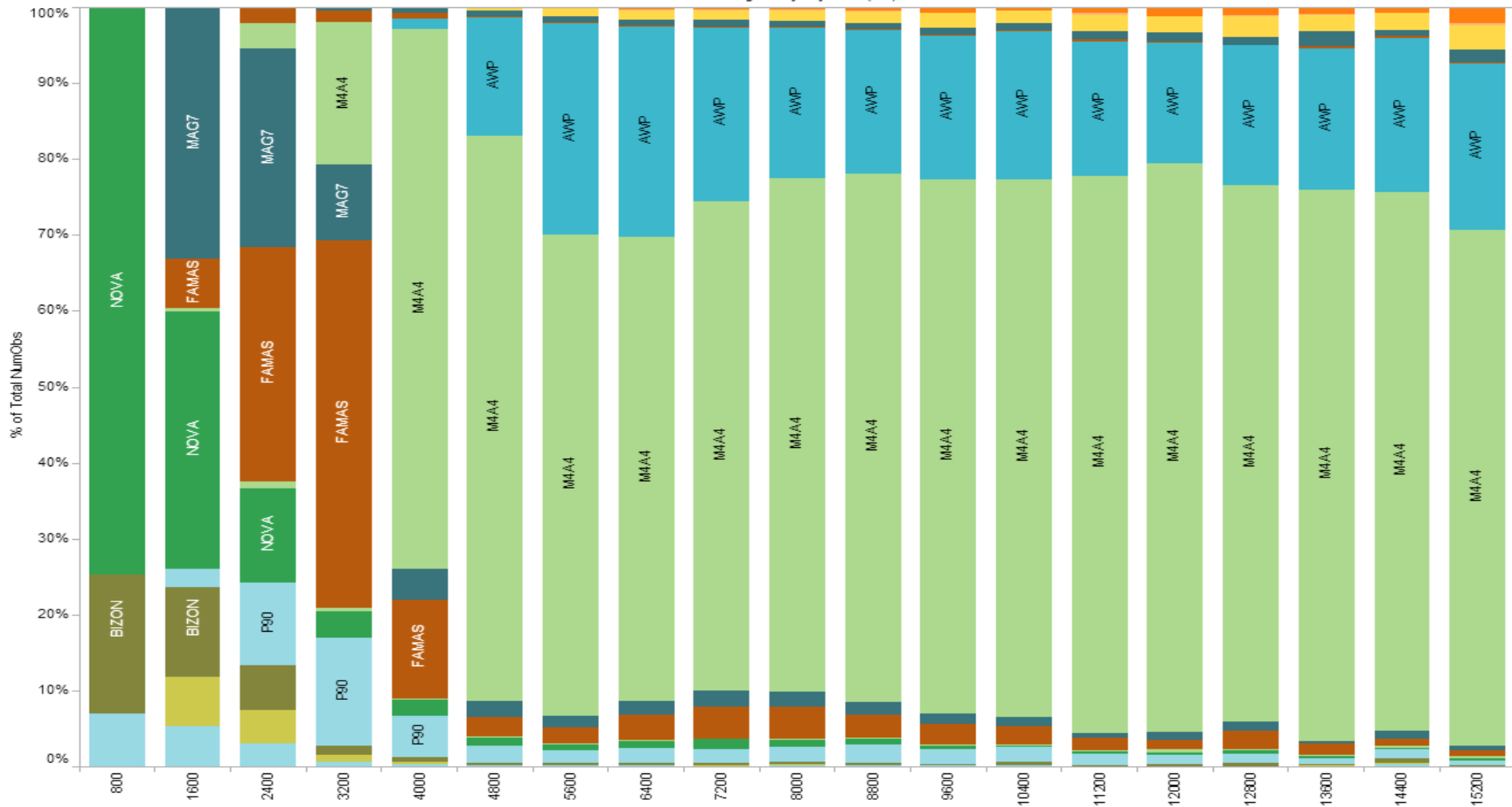
- 35% fewer negative words used in chat
- 32% fewer communication reports
- 1% of active player base is currently banned
- 61% of banned players only receive one ban



CS:GO

# Weapon Purchases by Budget

StartingMoneyAdjusted (bin)



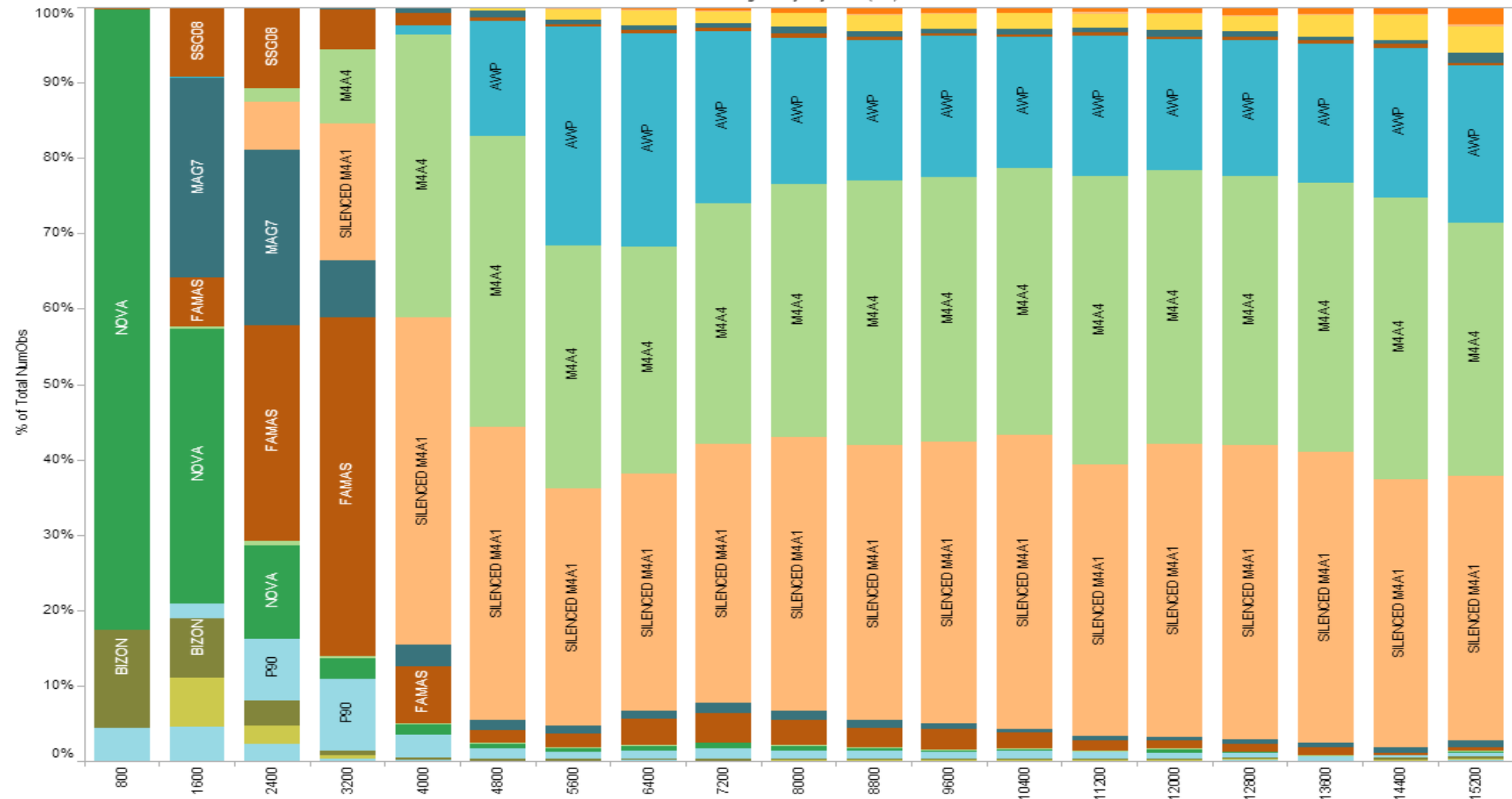
# Weapon Balance

- Explicit: M4A4 usage is high; few choices in late-game
- Data-driven: Purchase rates
- Theory-driven: Greater tactical choice → Player retention
- Measurements: Purchase rates, playtime, efficacy
- Iterative: Inform future design choices

Hypothesis: Creating a balanced alternative weapon will increase player choice and playtime

### Weapon Purchases by Budget

StartingMoneyAdjusted (bin)





# Results

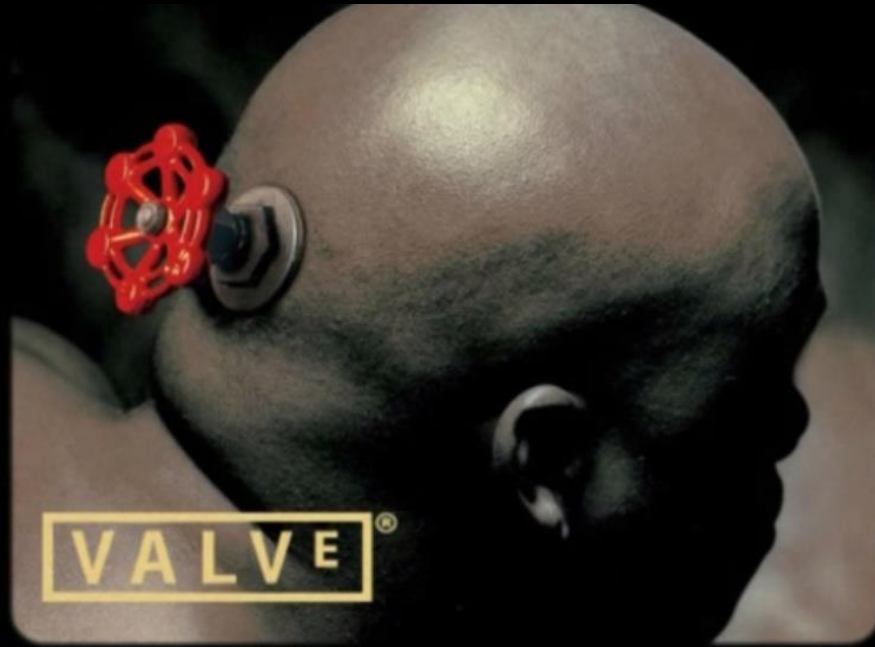
- ~ 50/50 split between new and old favorites
- Increase in playtime
  - Conflated with other updates
  - Difficult to isolate
- Open question as to whether or not increased weapon variability increases player retention

# Where Can You Begin?

- Start asking questions
- Gather data—any data
  - Playtests
  - Gameplay metrics
  - Steamstats
  - Forum posts/emails/Reddit



- **Tell us what data you'd like us to provide**



THANKS!!!

# Contact Info

Mike Ambinder

[mikea@valvesoftware.com](mailto:mikea@valvesoftware.com)