Making the Best of Imperfect Data

Turning the information we gather into a less biased, more complete, and wider-ranging set of meaningful conclusions.
Reflections on an Ideal World

If we think about where our problems lie, we don’t ignore them, and we improve our understanding. If we think about what could be possible, then we’re innovating and expanding the scope of our profession. If we understand how to link between these two approaches, then we’re making progress.
Overview

- The Current State of Affairs
- The Path Between
- The Future State of Affairs
The Current State of Affairs

- How we get data now
- Issues we face
- Information we lack
Data Collection

- Playtests
  - Direct Observation
  - Think Aloud
  - Usability
  - Q&A
- Metrics
  - Descriptive statistics
  - Quantifying behavior

"WE KNEW THAT ALREADY! SEEMS LIKE WE DIDN'T NEED TO DO THE RESEARCH AFTER ALL!"
Data Collection - Alternative Methodologies

- Surveys – Measurement of Opinion
- Eyetracking - Measurement of Attention
- Physiological Signals – Measurement of Emotion
- Experiments – Measurement of Effect
Data Analysis

- Statistical Tests
  - T-Tests, Correlations, Regressions, ANOVAs,
  - Frequentist vs. Bayesian
- Data Mining - Exploratory
- Machine Learning - Automated
Issues

- Biases in data
- Lack of resources
- Experimentation shortfalls
Data Interpretation

- What biases are present?
- What biases might be present?
- What biases can be removed?
Is the average price of German cars more or less than $100,000?

That’s too high.

Is it higher or lower than $20,000?

That’s too low.
Playtest Biases

- Playtesters know the company
- Playtesters know the game
- Playtesters know the genre
- Playtesters play in groups
- Playtesters are not unbiased
  - Want to impress
  - Want to profess
- WE are not unbiased
Data Source Biases

- Forums
- Emails
- In-game surveys
- Contaminated samples
- Expectations

http://xkcd.com/386/
Metric Biases

- Incomplete/Missing
- Confounded
- Incorrect
- Violates statistical assumptions
Resource Constraints

- Time
- Money
- Equipment
- Expertise
- Hardware/Storage space
- Capability to eliminate issues
Tradeoffs

- Which questions do we focus on and why?
- Where do we allocate resources?
- How do we decide to do so?
Experimentation

- Correlational vs. Causal
- Retrospective vs. Prospective
- Do we have a valid control?
- Do we have a valid test condition?

http://prologuegames.com/surface-pro-2/
Experimentation Failures

- Confounds
- Conflation of effects
- Inability to isolate effects
- Results-oriented experimentation
- Lack of iteration
- Not operationalizing ‘success’
- Lack of statistical power
What Information Are We Missing?

- Player sentiment
- Rationales for player choice
- Purchasing decisions
- Factors which contribute to game popularity
- Measuring game balance
- Operationalizing ‘fun’
- Operationalizing ‘immersion’
- . . .
Incomplete Information

- Behavioral correlates
  - For sentiment
  - For choice
  - For explanations
- Measurable behavioral correlates
The Path Between the Present and the Future

- Fixing the problems we face
- New data to gather
- New methodologies to try

The Road Not Taken

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.

- Clean up our datasets
- Match up methodologies with suitable data/questions
- Identify confounds

http://tay.kotaku.com/5-reasonably-serious-step-to-not-going-bankrupt-this-st-1593698005
Data Analysis

- Add technical ability
- Improve the usability of statistical tools
- Add automatization of analysis
Data Interpretation

- Be cognizant of biases
- Honest about their existence
- And work to remove them
Experiments

- The Scientific Method
- Understand the limitations of what we’re doing
  - Retrospective vs. Prospective
  - Correlational vs. Causal
- Iteration
- Add theories/knowledge to the world
Theory
create or modify the theory

Observation
perform the experiment

Prediction
design an experiment to test the prediction

Experiment
use the theory to make a prediction
New Data

- Real-time analysis
- More complete data
- Experimental groups
Realtime Analysis

- Contextual surveys
- In-game manipulations
- Player sentiment
Complete Datasets

- Increases in computing power
- Smarter inferences
- Spatial analysis
Experimental Groups

- Segmentation of players
- Sample sizes in the millions
- Valid controls
- Valid test conditions

Novel Methodologies - Physiological

- Biofeedback
  - Measurements of arousal
  - Measurements of valence
- Eyetracking
- Posture? Gestures? Smell? EEGs?
Novel Methodologies – Analytical

- Structured Q&As? Improved Surveys?
- Remove bias from verbal reports
- Letting people play for as long as they want
  - Maybe the single biggest change we could implement
- Ways to test multiplayer
- What haven’t we thought of?
The Future State of Affairs

- The perfect world
- Are any problems unsolvable?
- Is any data ungatherable?
The Perfect World

- Our data is clean
- Our data is complete
- Our data is free from bias
- Our data is adaptable
- We can measure anything
The Perfect World – Data Collection

- All data is collected
- Instantaneously available for analysis
- Confounds are readily identifiable
- People give more honest responses
The Perfect World – Data Analysis

- Appropriate analyses are readily identifiable and easily applied
- Tools are available to easily explore datasets
- Automated processes are constantly pattern matching
The Perfect World – Data Interpretation

- We can account for biases
- We can remove biases
- We can prevent biases
The Perfect World – Constraint Removal

- Time
- Money
- Equipment
- Expertise
- Hardware/Storage Space
- Capability
Questions We Can Answer

- Player sentiment
- Player choice
- Purchase decisions
- Game popularity
- Game balance
- “Fun”
- “Immersion”
Questions We Can’t Answer
What Problems Remain?

- This is a theoretical exercise
- Constraints will always exist
- Tools will never be perfect
- Data will always be biased
What Data Remains?

- Behavioral correlates
- Access to introspective processes
- Measurement of situational factors
[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.
The Quickest Path

- Be aware of biases
- Acquire statistical abilities
- Information exchanges
- Never stop questioning
The Biggest Wins

- Let people play as long as they want
- Be aware of biases
- Measure physiological signals
- Record more data
- Experiment
If it can be destroyed by the truth, it deserves to be destroyed by the truth
- Carl Sagan
Thanks!
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