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Game Developers Conference®

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# Valve's Approach to Playtesting: The Application of Empiricism

Mike Ambinder, PhD

Game Developer's Conference

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# Goal

- Review pros/cons of various playtest methodologies
- Discuss which data is best derived from which methodology
- Focus more research on user research



# Overview

- Valve's (external) playtest philosophy
- Traditional playtest methodologies
  - Qualitative
- Technical playtest methodologies
  - Measured



# Overview

- Traditional Playtest Methodologies
  - Direct Observation
  - Verbal Reports
  - Q&As
- Technical Playtest Methodologies
  - Stat Collection/Data Analysis
  - Design Experiments
  - Surveys
  - Physiological Measurements

# Valve's Game Design Process

- Goal is a fun game →
- Game designs are hypotheses →
- Playtests are experiments →
- Evaluate designs off playtest results →
- Repeat

# Playtesting Goal

- Fun
- Not bug testing
- Not game balancing
- DEFINITELY not focus testing

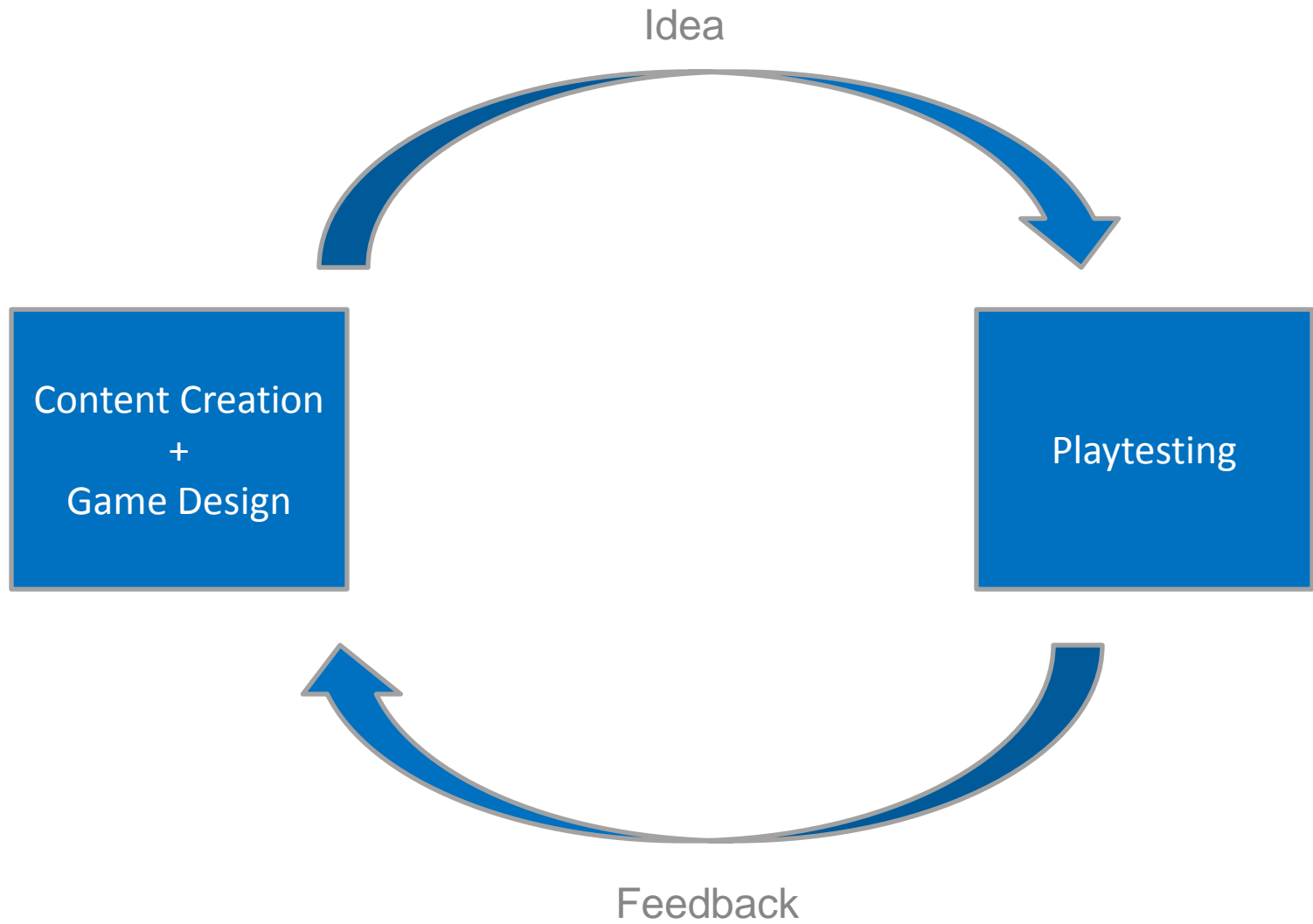


# Ancillary Benefits

- Idea generation
- Identify problem areas
- Solve design arguments
- Aid other production aspects

# Valve's Philosophy

- We want to make informed decisions
  - Get data early, get data often
  - Iterate constantly
- We don't know what's best (players do)
- Create a feedback loop between design and playtest





# Valve's Philosophy

- Playtesting continues after we ship
  - Gameplay stats
  - Forum responses
  - Fan feedback
- Always gathering data for the future
  - Patches/updates
  - Upcoming games

# Traditional Methods

- Direct Observation
- Verbal Reports
- Q&As

# Direct Observation





# Direct Observation

- “Typical” playtest
  - Watch people play the game
  - Observe their gameplay/behavior
  - Simulate at-home experience
- Have a design goal



10 120

15

Frensis

WU

Zany

+100







QUARANTINE  
CONTAGIOUS DISEASE  
NO ONE MAY ENTER OR  
LEAVE THIS BUILDING WITHOUT  
THE CIVIL ENGINEER'S AND  
DEFENSE AGENT'S  
PERMISSION. VIOLATORS  
WILL BE PROSECUTED.  
NCEDA

Bill


50 480

15






Louis



Bill



Zoey



+100

# Direct Observation

- + Get a feel for player interaction with game
- + Importance of what people do—not what they say
- Presence of observers can bias results
- Salient event can slant interpretation
- Behavior requires interpretation



# Verbal Reports



Zombies are scary...this textbox is really big to hide stuff on the white board that shouldn't be seen in the presentation...the assault rifle is my favorite...

# Verbal Reports

- Think-aloud protocol:
  - People describe their actions as they play
  - Unprompted and uncorrected
- In conjunction with direct observation



ES11

Louis

32 180

7



Don't shoot teammates!

Bill

Louis

Francis

+00

# Verbal Reports

- + Enables realtime glimpse into player thoughts, feelings, and motivations
- + Bring up unnoticed details
- + Effective for 'why' questions
- Interfere with gameplay/create an artificial experience/distracting
- Inaccurate and biased

# Q&A



# Q&A

- Structured (usually) querying of playtesters
- Validate playtest goals
- Source of supplemental information





10/78

1

Zoey

Don't shoot teammates!

Zoey

Francis

Lewis

+04



# Q&A

- + Answer specific design questions
- + Determine specific player intent
- Group biases (anchoring, social pressure, saliency, etc.)
- People don't know why they do what they do
- Potential for biased questions

# Our Q&A Procedure

- Survey
- Individual Q&A
- Group Q&A
- Be cautious

# Benefits of Traditional Methods

- + Nothing beats direct gameplay observation
- + Determine major gameplay, navigation, and content issues
- + Get an idea of player thoughts/mental models
- + Get feedback on design choices

# Issues with Traditional Methods

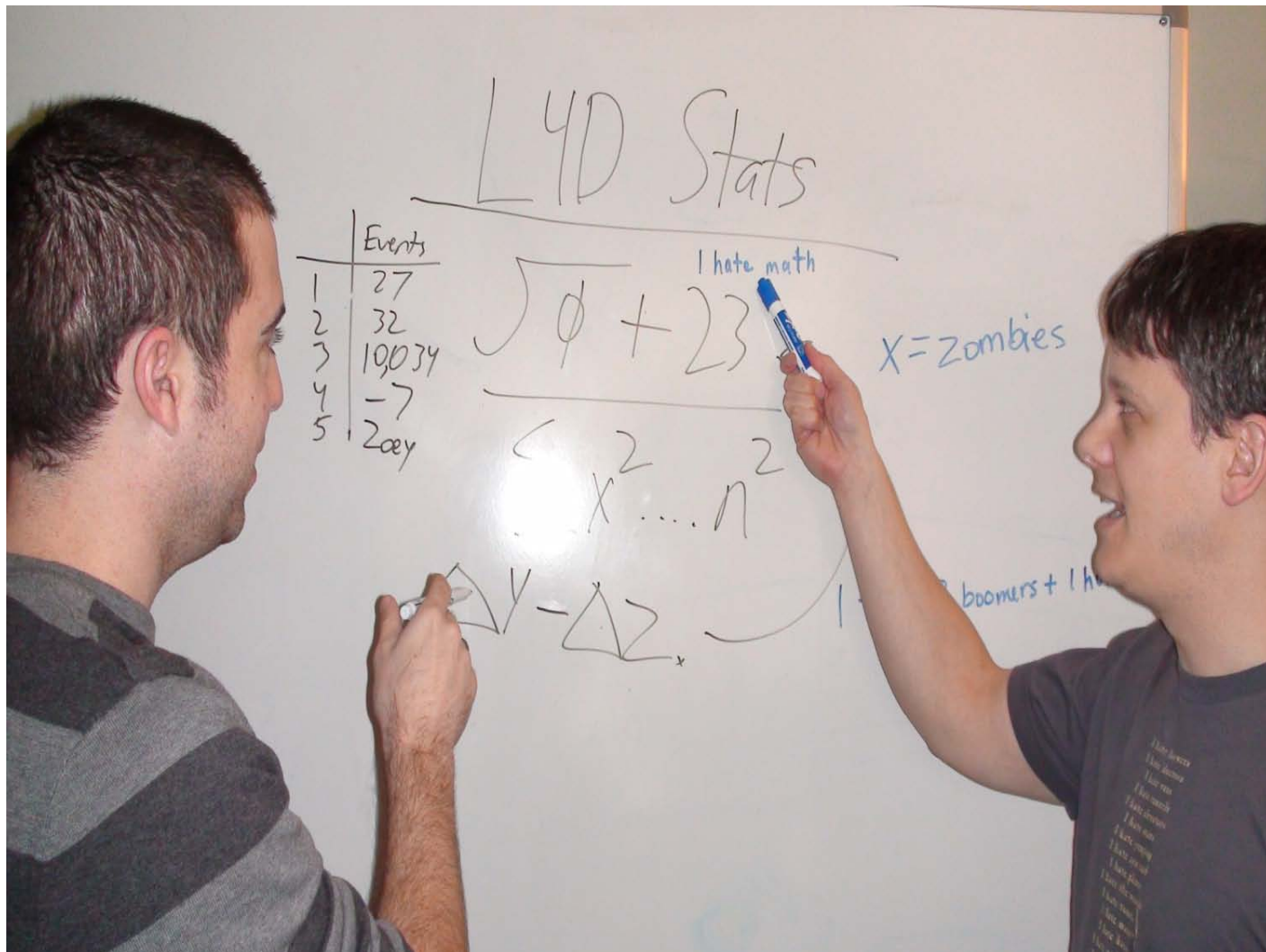
- Artificial gameplay sessions
- Many potential biases
- Distorted data
- Lack of empiricism
- Missing elements of objectivity
- Sometimes difficult to establish emotions, baselines, and independence

# Technical Approaches

- Stat collection/analysis
- Design experiments
- Surveys
- Physiological measurements



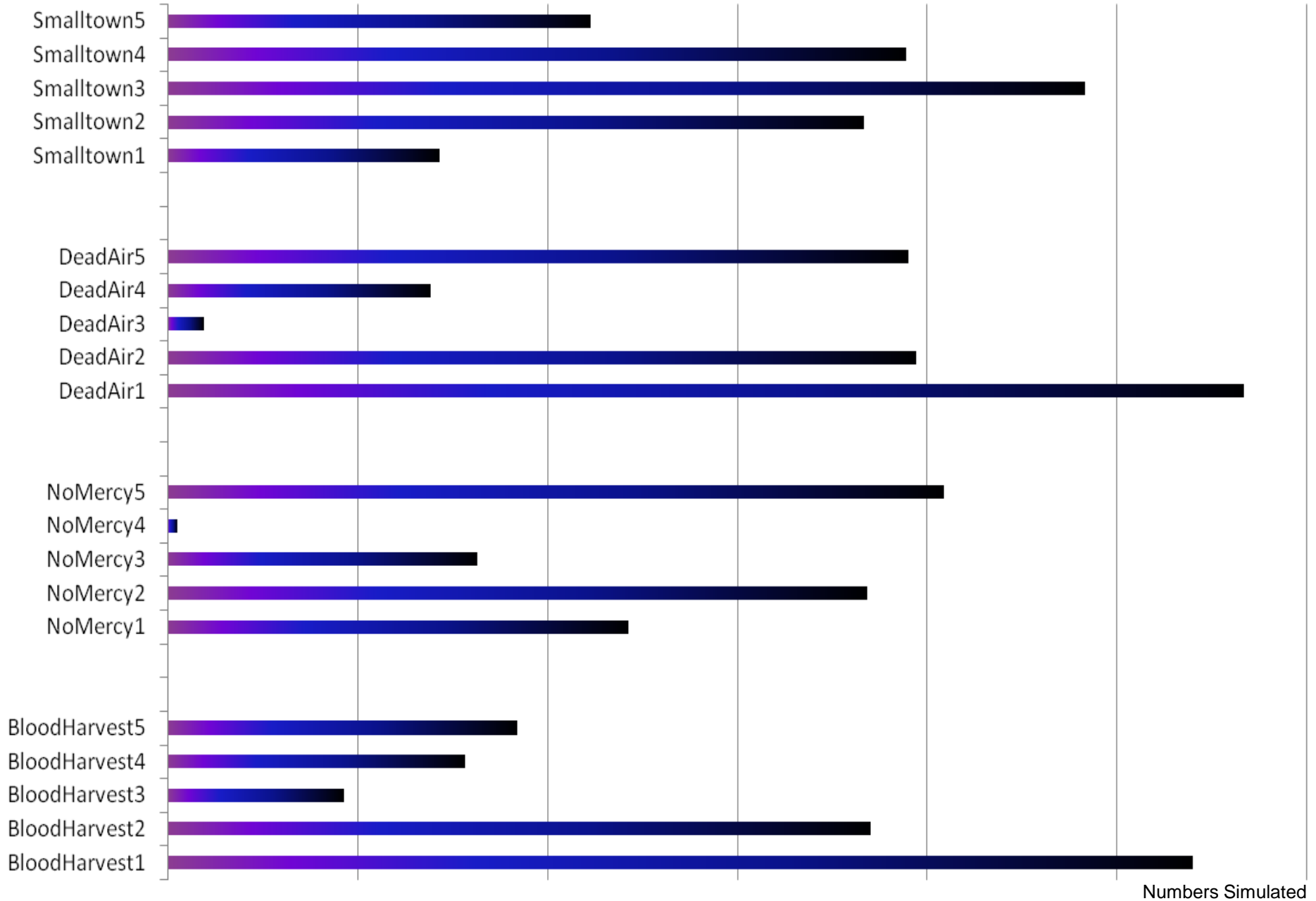
# Stat Collection/Analysis



# Stat Collection/Analysis

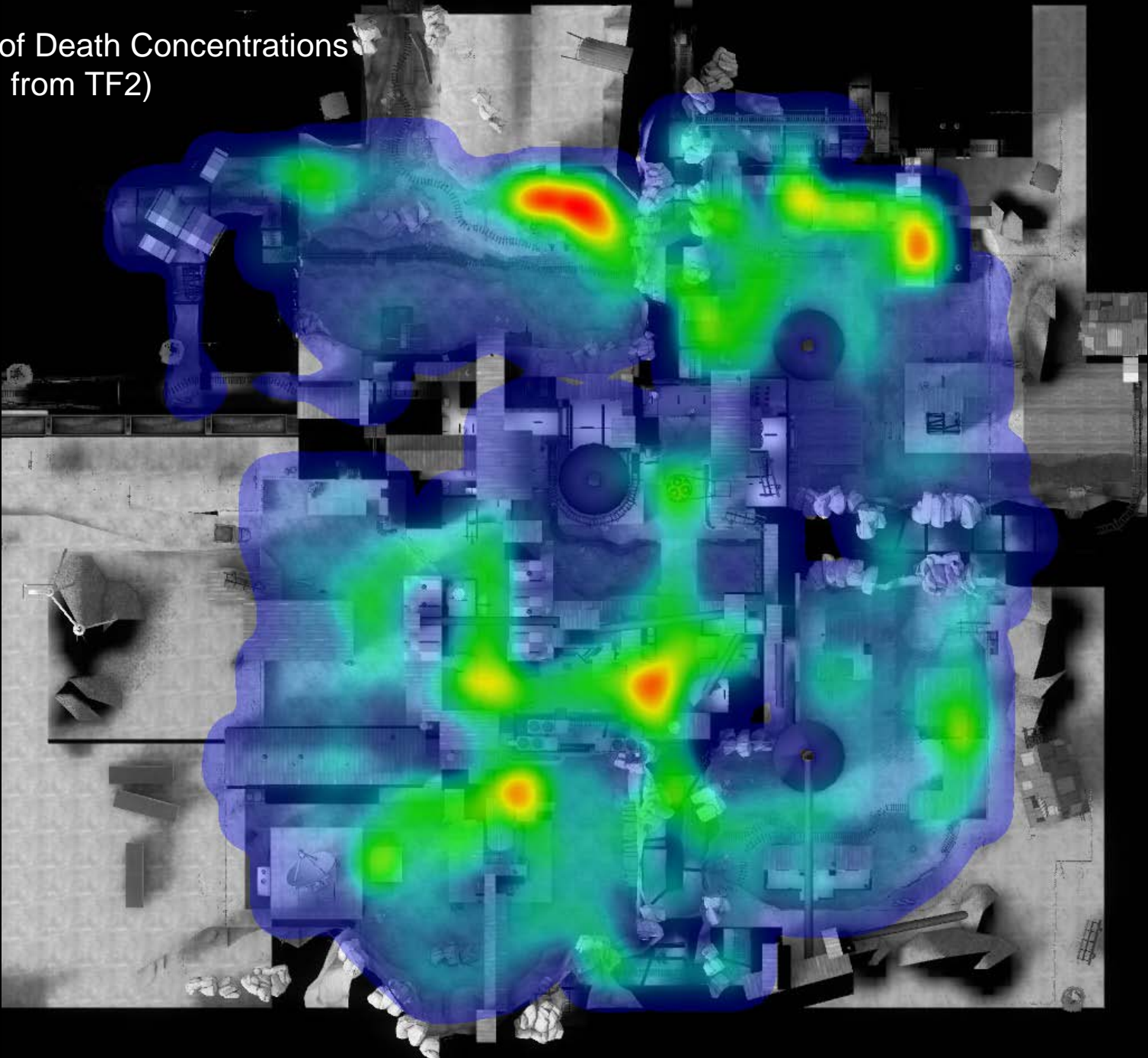
- Record of gameplay behaviors
  - Deaths, level times, friendly fire, ...
- Objective measurements
- Aggregate perspective
- Quantify behavior
- Opportunity for analyses
  - T-tests
  - Regressions
  - ...

# L4D Average Deaths





Heatmap of Death Concentrations  
(Dustbowl from TF2)





# ACHIEVEMENTS

Achievement name		% of players
	<b>DRAG AND DROP</b> Rescue a Survivor from a Smoker's tongue before he takes damage.	92.4%
	<b>BRAIN SALAD</b> Make 100 headshot kills.	90%
	<b>TONGUE TWISTER</b> Kill a Smoker who has grabbed you with his tongue.	88.9%
	<b>BLIND LUCK</b> You or another Survivor take no damage after being vomited on by a Boomer.	88.8%
	<b>MY BODYGUARD</b> Protect any Survivor from an attacking Infected 50 times.	84.3%
	<b>TANKBUSTERS</b> Kill a Tank without it dealing any damage to a Survivor.	84%
	<b>PYROTECHNICIAN</b> Blow up 20 Infected in a single explosion.	83.7%
	<b>NO SMOKING SECTION</b> Kill 10 Smokers as they are pulling helpless Survivors.	78.5%
	<b>OUTBREAK</b> Catch a rare strain of infection, then pass it on to someone else.	76.4%
	<b>HUNTER PUNTER</b> Shove a Hunter off of a pinned and helpless Survivor.	76.4%
	<b>101 CREMATIONS</b> Set 101 Infected on fire.	75.6%
	<b>HERO CLOSET</b> Rescue a Survivor trapped in a closet.	74.6%
	<b>TOWERING INFERNO</b> Light a Tank with a Molotov.	72.8%
	<b>WITCH HUNTER</b> Kill a Witch without any Survivor taking damage from her.	70%
	<b>NO-ONE LEFT BEHIND</b> Beat a campaign with all 4 Survivors.	66.8%
	<b>SPINAL TAP</b> Kill an Infected with a single blow from behind.	64.5%
	<b>GROUND COVER</b> Save another Survivor from a Special Infected while on the ground.	64.1%
	<b>DEAD STOP</b> Punch a Hunter as he is pounding.	63.3%
	<b>BURN THE WITCH</b> Light a Witch with a Molotov.	61.6%
	<b>MERCY KILLER</b> Survive the No Mercy campaign.	57.6%
	<b>JUMP SHOT</b> Headshot a Hunter while he's leaping.	55.8%
	<b>TOLL COLLECTOR</b> Survive the Death Toll campaign.	54%
	<b>DEAD BARON</b> Survive the Dead Air campaign.	53.9%

**GROUND COVER**

Save another Survivor from a Special Infected while on the ground.

64.1%

**DEAD STOP**

Punch a Hunter as he is pouncing.

63.3%

**BURN THE WITCH**

Light a Witch with a Molotov.

61.6%

**MERCY KILLER**

Survive the No Mercy campaign.

57.6%

**JUMP SHOT**

Headshot a Hunter while he's leaping.

55.8%

**TOLL COLLECTOR**

Survive the Death Toll campaign.

54%

**DEAD BARON**

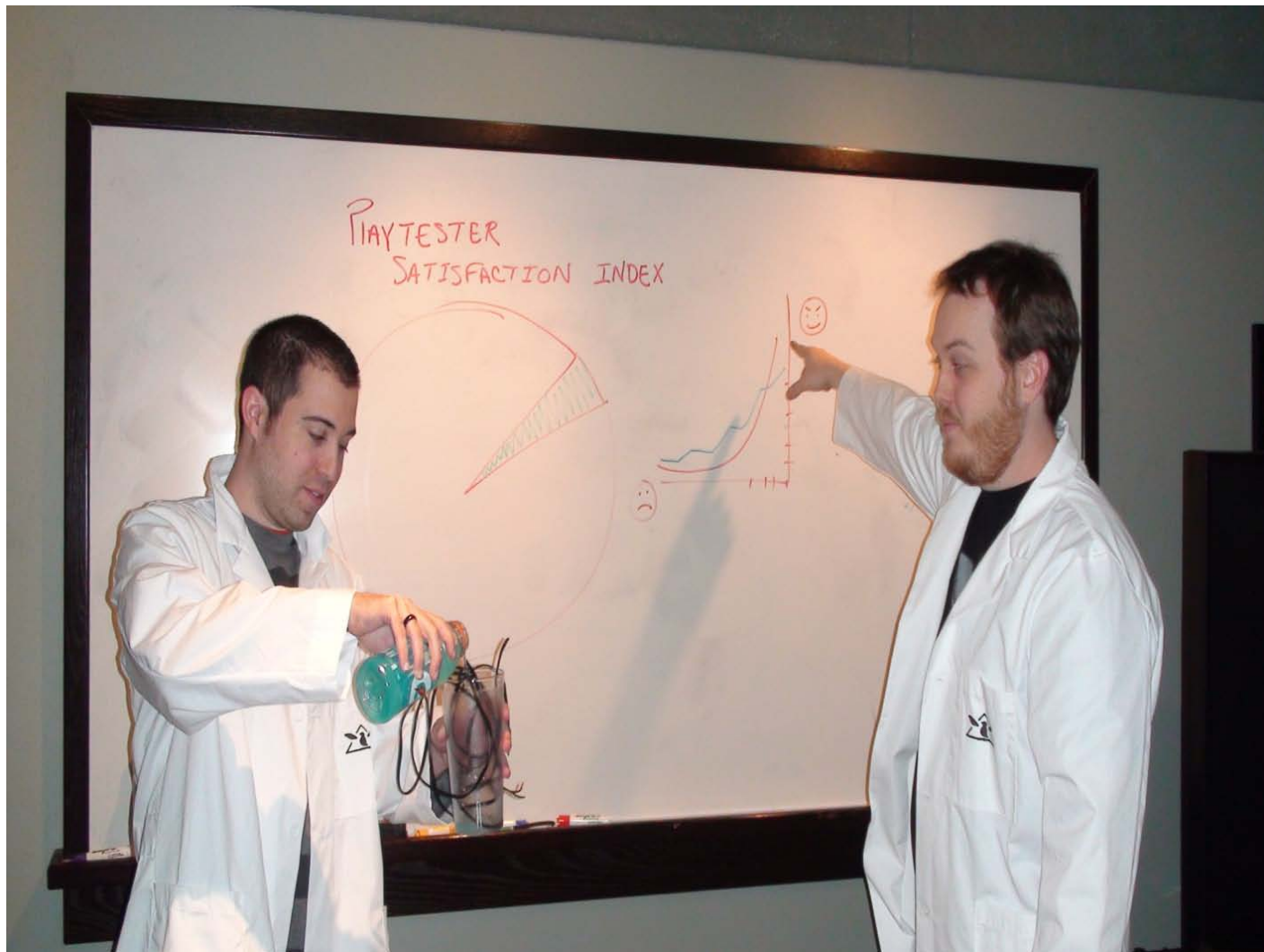
Survive the Dead Air campaign.

53.9%

# Stat Collection/Analysis

- + Objective notions of player behavior
- + See global trends
- + Readily enables comparisons, baseline establishment, and metric creation
- + Track changes over time
- Averages hide extreme examples
- Miss nuance (lacking context)
- Requires rigor
- Can see 'illusory' patterns

# Design Experiments





# Design Experiments



# Design Experiments

- Hypothesis testing
  - Compare two or more conditions
  - Collect data
  - Verify hypothesis
- Predict player behavior
  - Define set of variables
  - Investigate resulting relationships

# TEAM FORTRESS 2

VALVE

## THE SCOUT UPDATE

THE RESULTS ARE IN.  
THE UPDATE'S OUT.  
NOW IT'S TIME TO...

# PLAY BALL!

### COMMUNITY VOTED UNLOCKABLES ORDER

#### 1. THE FORCE-A-NATURE

(REQUIRES 10 ACHIEVEMENTS TO UNLOCK)

17,219 VOTES (42.53%)

#### 2. THE SANDMAN

(REQUIRES 15 ACHIEVEMENTS TO UNLOCK)

13,806 VOTES (34.10%)

#### 3. 'BONK' ENERGY DRINK

(REQUIRES 20 ACHIEVEMENTS TO UNLOCK)

9,463 VOTES (23.37%)



VALVE

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# Design Experiments

- + Enables more informed decision-making
- + Objective answer
- + Saves time in the long run
- Costs time (in the short run) and money
- Right questions aren't always clear
- Proper experimental design is a process



# Surveys



# Surveys

- Set of standardized questions
- Forced choice responses
- Quantify feedback/opinions
- Player categorization

How challenging were the following enemies (1 = very easy; 7 = very hard)?

Boomer:	1	2	3	4	5	6	7
Common Infected:	1	2	3	4	5	6	7
Hunter:	1	2	3	4	5	6	7
Smoker:	1	2	3	4	5	6	7
Tank:	1	2	3	4	5	6	7
Witch:	1	2	3	4	5	6	7

Please rank order your preference for the following weapons from 1 (most liked) to 12 (least liked)

- Assault Rifle \_\_\_\_\_
- Auto Shotgun \_\_\_\_\_
- Dual Pistols \_\_\_\_\_
- Gas Can \_\_\_\_\_
- Hunting Rifle \_\_\_\_\_
- Molotov Cocktail \_\_\_\_\_
- Mounted Turret \_\_\_\_\_
- Pipe Bomb \_\_\_\_\_
- Pistol \_\_\_\_\_
- Propane Tank \_\_\_\_\_
- Pump Shotgun \_\_\_\_\_
- SMG \_\_\_\_\_



# Surveys

- + Get less biased responses
- + Validate responses (repetitive questions)
- + Forcing participants to make a choice helpful for revealing preference
- + Ratings enable comparisons (over time and with different iterations)
- Eliminate nuance
- Difficulty in converting ratings to meaningful decisions
- Limited solution space



# Physiological Measurements



# Physiological Measurements

- Measurements of biological response
- Create proxies of player state
- Involuntary
- Objective—can't be faked
- Quantify emotion

# Valence and Arousal

- Valence = positive or negative emotion
- Arousal = magnitude of emotion



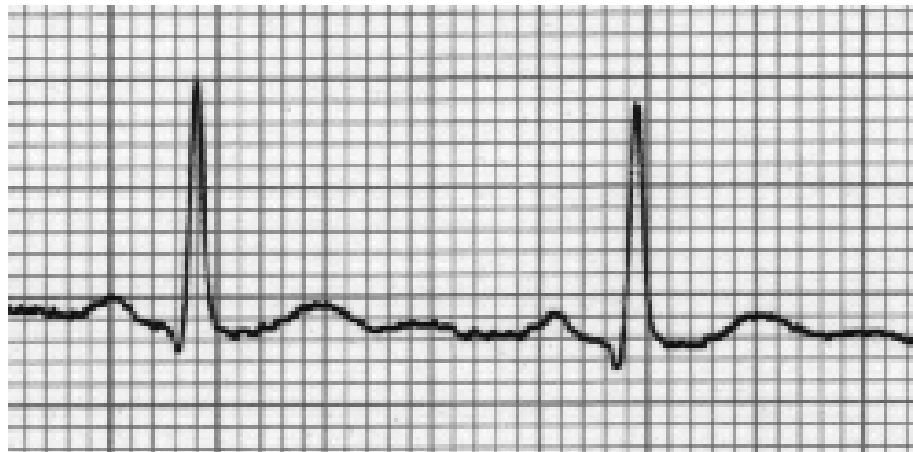
# Arousal





# Heartrate

- Beat to beat interval
- Measure baseline rate and changes
- Most basic measure of arousal
- Fourier transforms to distinguish emotion



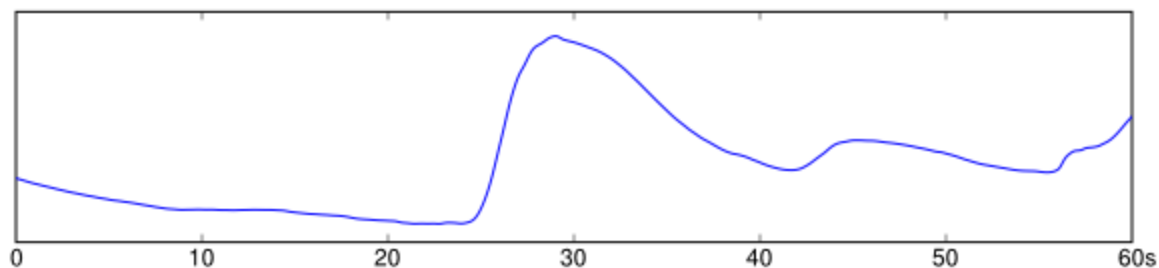
<http://en.wikipedia.org/wiki/File:EKG2.png>

# Heartrate

- + Simple to collect
- + Accurate correlate of arousal
- + Good metric for comparison
- Intrusive
- Delayed response to stimuli
- Variable

# Skin Conductance Level

- Electrical resistance of the skin
  - Correlate with arousal
  - Maybe other emotions as well
- Can look for spikes (both responsive and anticipatory)



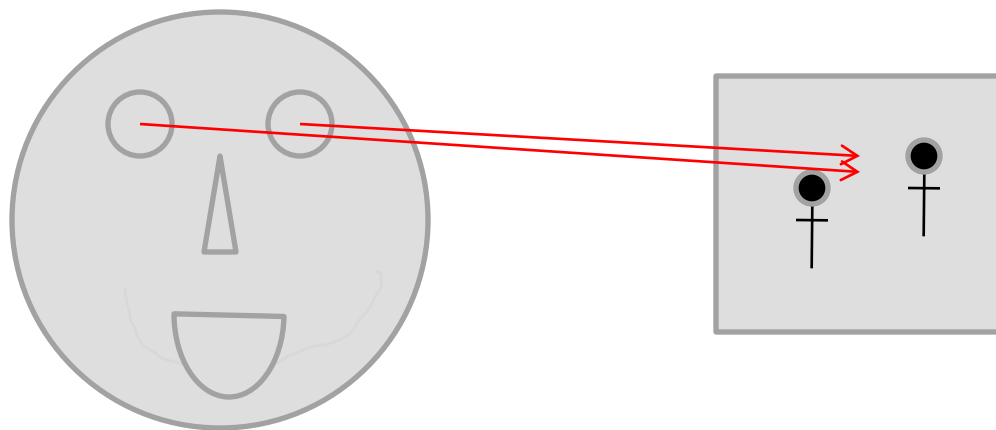
# Skin Conductance Level

- + Excellent correlate with arousal
- + Good metric for comparison
- + Adept at detecting transient responses
- Intrusive
- Susceptible to other factors
- Direct 1:1 relationship doesn't exist



# Eyetracking

- Camera focused on the eyes
- Determine where the eyes are looking
- Real-time insight into player thought processes
- Blink rate/pupil dilation



# DANS, KÖN OCH JAGPROJEKT

På jakt efter ungdomars kroppsspråk och den "synkretiska dansen", en sammansmältning av olika kulturers dans, har jag i mitt fältarbete under hösten rört mig på olika arenor inom skolans värld. Nordiska, afrikanska, syd- och östeuropeiska ungdomar gör sina röster hörda genom sång, musik, skrik, skratt och gestaltar känslor och uttryck med hjälp av kroppsspråk och dans.

Den individuella estetiken framträder i kläder, frisyrer och symboliska tecken som förstärker ungdomarnas "jagprojekt" där också den egna stilen i kroppsrörelserna spelar en betydande roll i identitetsprövningen. Upphållsrummet fungerar som offentlig arena där ungdomarna spelar upp sina performanceliknande kroppsspråk

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- HL2 Eyetracking Video



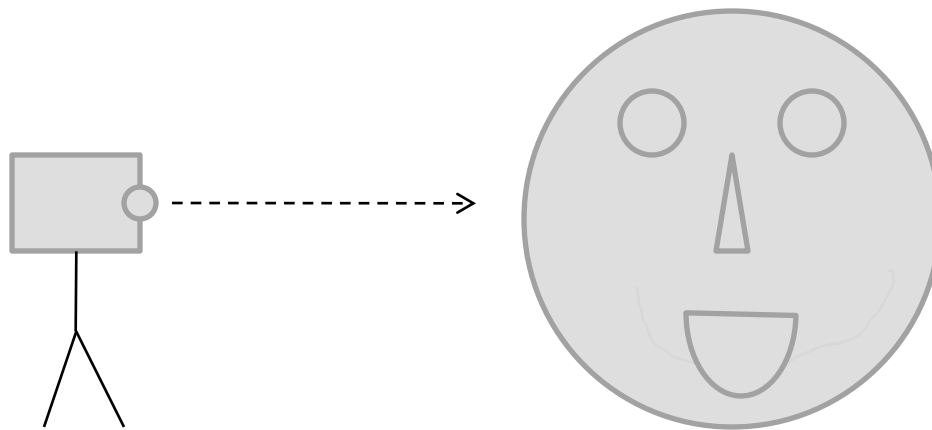
# Eyetracking

- + Effective metric of player attention/gaze
- + Excellent tool for interface design
- + Provides understanding of scene interpretation
- Expensive
- Can be intrusive
- Time consuming
- Can lead to costly over-analysis



# Face Recording

- Observation of facial expression
- Determination of player emotion
- Tied into gameplay



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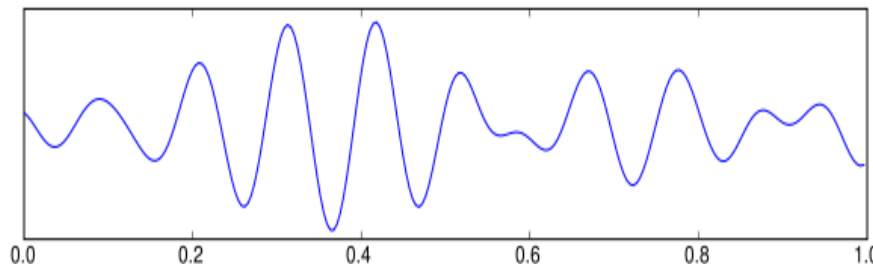
- Example video

# Face Recording

- + Provides emotional context
- + Excellent metric of player emotion
- Intrusive
- Requires experienced coders
- Not always reliable
- Biased reactions

# EEG

- Measurement of electrical potentials in the brain
- Various frequencies are correlated with emotional state
  - Alpha (relaxation)
  - Beta (thinking, engagement)
  - Delta (fatigue)



[http://en.wikipedia.org/wiki/File:Eeg\\_alpha.svg](http://en.wikipedia.org/wiki/File:Eeg_alpha.svg)

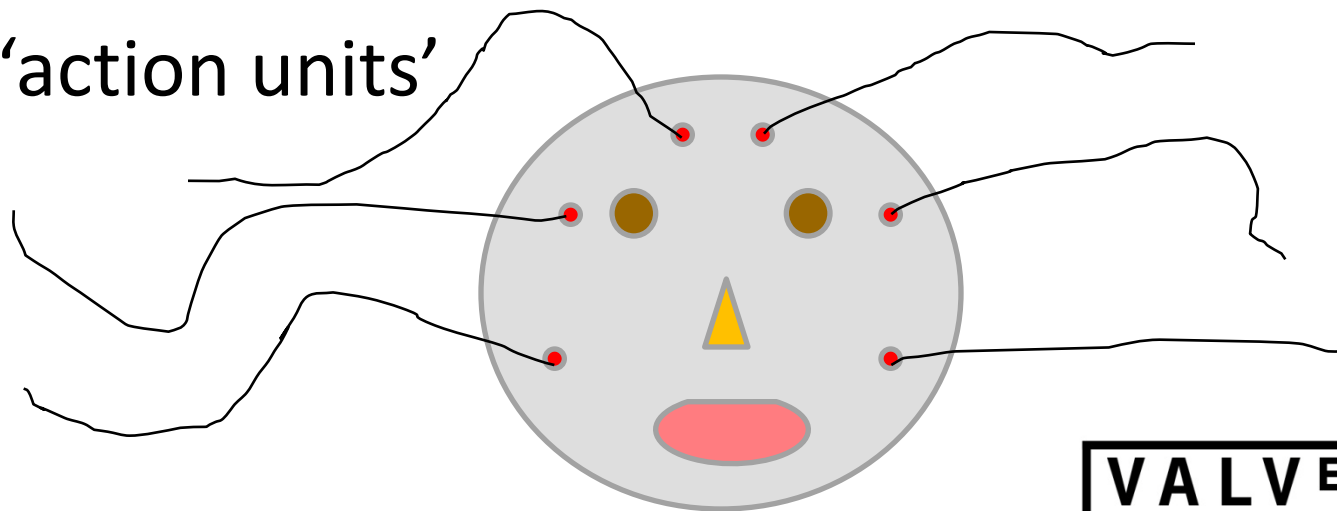


# EEG

- + Good at measuring arousal, engagement, etc.
- + Potential for fairly sophisticated determinations down the road
- Expensive
- Very intrusive
- Noisy
- Hard to control/validate

# EMG

- Sensors placed at varying points on the face
- Measurement of facial muscle contraction/relaxation
- Determinant of emotion based on 'action units'



# EMG

- + Most accurate measure of emotion
- + Real-time determination
- Expensive
- Very intrusive

# Other Techniques

- Body temperature
- Gesture recognition
- Muscle tension
- . . .



# Physiological Measurements

- + More objective measurements of player state
- + Quantifiable emotional response
- + Analysis/comparison metrics
- Expensive
- Intrusive
- Artificial experience
- Requires experimental control

# Benefits of Technical Approaches

- + Application of empirical data to game design
- + Objective (for the most part)
- + Enable testable hypotheses about player emotional state
- + Quantify behavior

# Issues with Technical Approaches

- Expensive
- Resource intensive
- Impractical
- Lacking nuance

# Summary

- Do your QA early
- Understand pros/cons of existing methods
- Correctly frame design questions
- Be aware of emerging technologies



# Acknowledgments

- Charlie Burgin
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- John Morello

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# Questions?