

Game Design Theory

Part 2: Mechanics

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EECS-397/497: GAME DEVELOPMENT STUDIO
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NORTHWESTERN UNIVERSITY

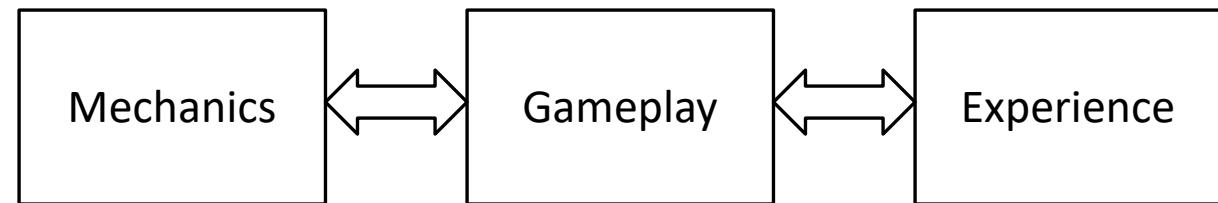


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Let's recap our model so far

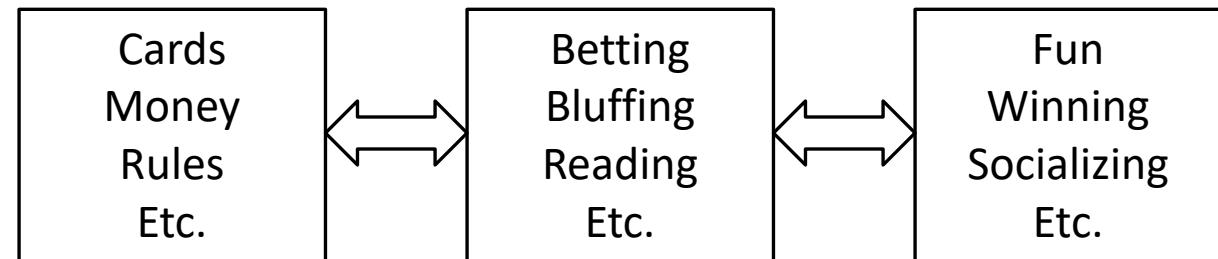
Mechanics

- Game elements, rules, code
- Player's inputs and outputs



Gameplay

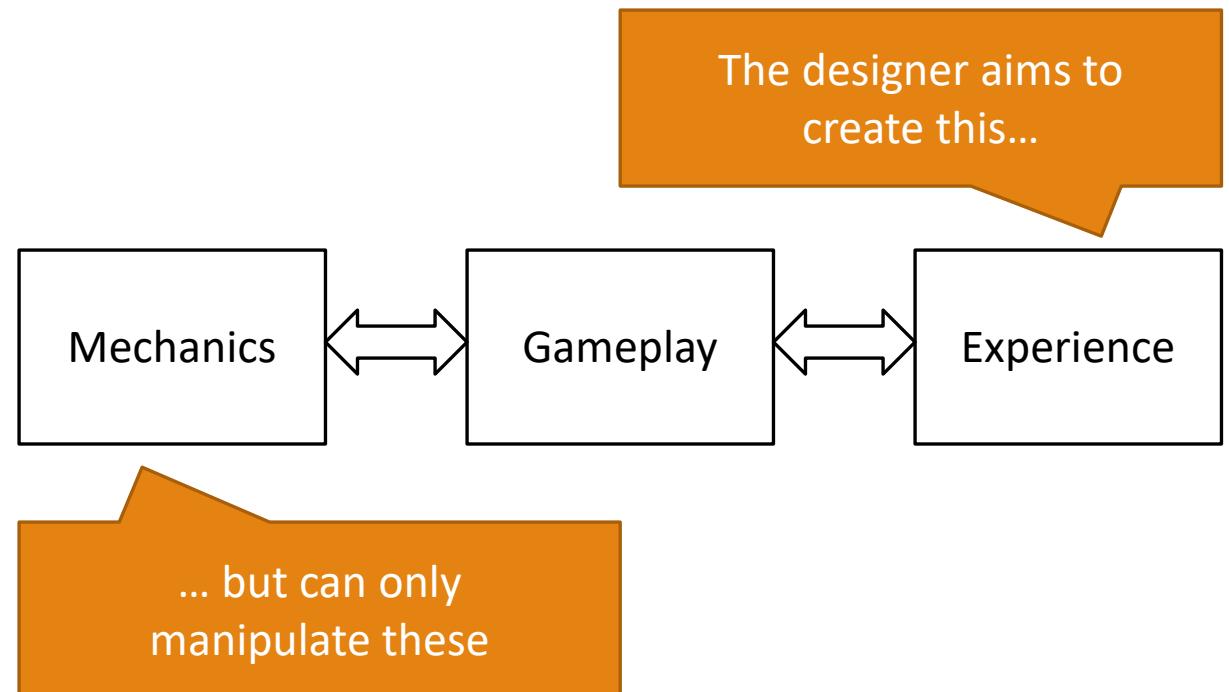
- How the game unfolds over time
- Activity / behavior/ patterns of play



Experience

- The feels / the fun

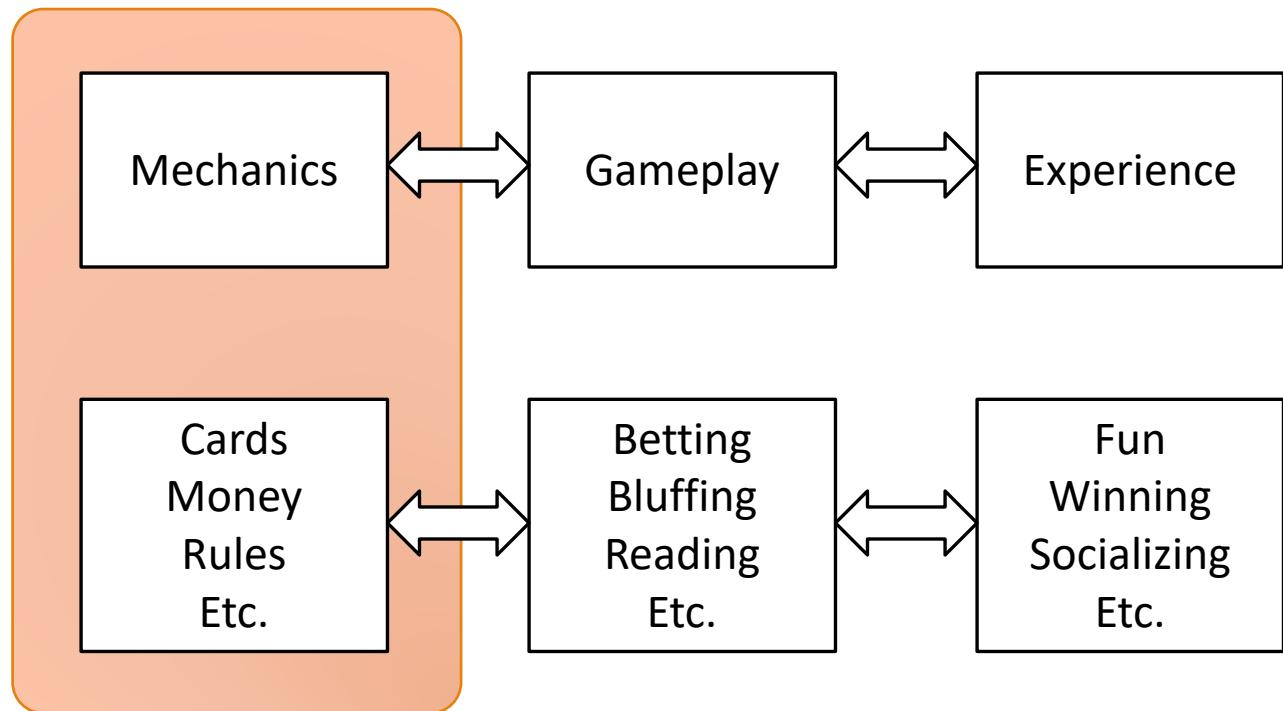
Let's recap our model so far



Roadmap

Today – start from the other end

- Mechanics
- Systems



Mechanics

What are the basic building blocks?

- “Nouns” or game elements (game pieces, objects, money, etc)



player



designer

Mechanics

What are the basic building blocks?

- “Nouns” or game elements
- “Verbs” or actions you can take



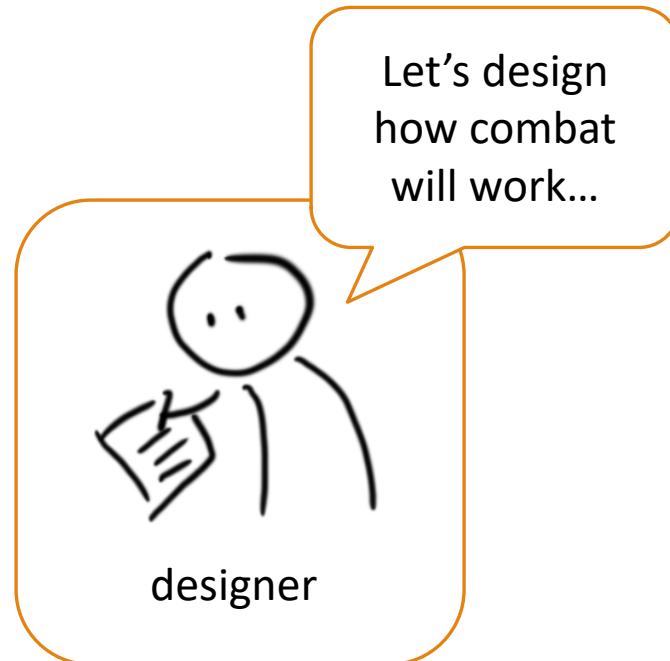
Mechanics

What are the basic building blocks?

- “Nouns” or game elements
- “Verbs” or actions you can take
- “Grammar” or rules of how they work together



player



designer

Mechanics

Elements + Actions + Game Rules
(or: Nouns + Verbs + Grammar)

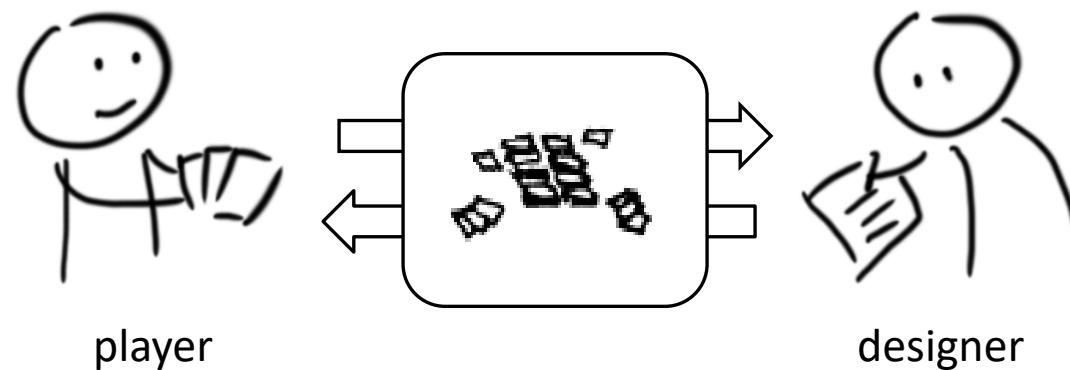
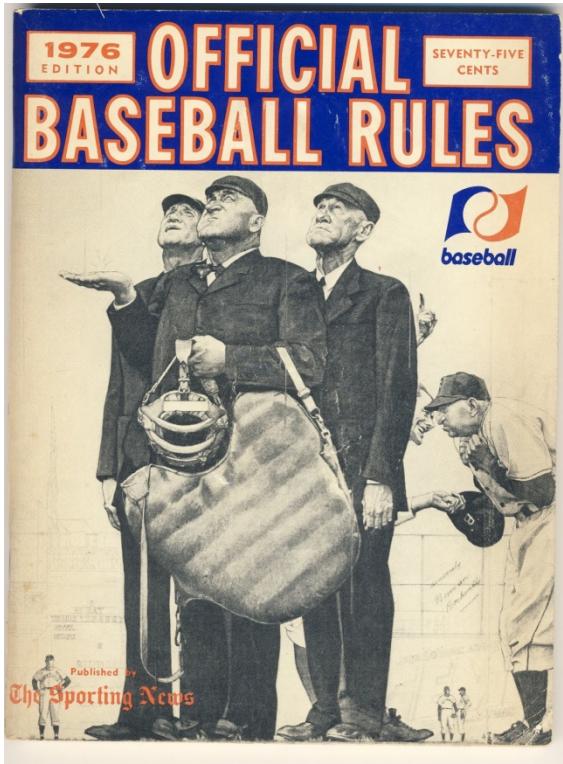


image credit: xkcd <3

Mechanics



Mechanics



Mechanics

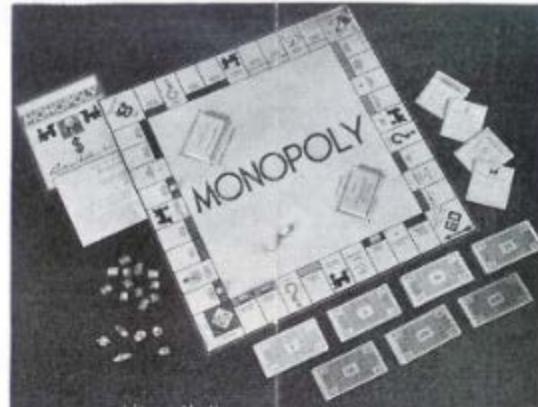


Explicit vs Implicit

Can we list all the mechanics in Monopoly?

- Definitely!

Image credit: worldofmonopoly.com



The Game of **MONOPOLY**

REG. U. S. PATENT OFFICE
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BRIEF IDEA OF THE GAME

THE IDEA OF THE GAME is to BUY and RENT or SELL properties so profitably that one becomes the wealthiest player and eventual MONOPOLIST. Starting from "GO" move Tokens around the Board According to throw of Dice. When a Player's Token lands on a space NOT already owned, he may Buy it of the BANK; otherwise it is Auctioned off to the Highest Bidder. The OBJECT of Owning property is to Collect Rents from Opponents stopping there. Rentals are greatly increased by the erection of Houses and Hotels, so it is wise to build them on some of your Lots. To raise more money Lots may be mortgaged to the Bank. Community Chest and Chance spaces give the draw of a Card, instructions on which must be followed. Sometimes players land in Jail! The game is one of shrewd and amusing trading and excitement.

RULES

For from Three to Seven Players

EQUIPMENT

MONOPOLY Equipment consists of the BOARD with spaces indicating Avenues, Railroads, Utilities, Rewards and Penalties over which the players' pieces are moved. There are Two DICE, PLAYING PIECES (sometimes called Tokens), thirty-two green HOUSES and Twelve red HOTELS and Two sets of Cards for CHANCE and COMMUNITY CHEST spaces. There are Title Deed Cards for every property and Scrip representing MONEY of various denominations.

PREPARATION

PLACE the Board on a good-sized table putting the Chance Cards and Community Chest cards face-down on their allotted spaces on the board. Each player is provided with One PLAYING PIECE to represent him on his travels around the board. Each player is given \$1500. All other equipment goes to the BANK. One of the players is elected

Explicit vs Implicit

Can we list all the mechanics in Monopoly?

- Definitely!

But how about Civilization?

Or Diablo?



Paper Prototyping?

Can we prototype games on paper?

We *could*, but...

- Computer games usually use implicit mechanics
- Physical games really need explicit mechanics

→ Paper prototyping is not generally used in the computer games industry

- Except for a few special cases



Broad Families of Mechanics

1. Resource Management
2. Uncertainty
3. Progression
4. Action

Example: Tower Defense

Everyone knows TD games, right?



Example: Tower Defense

1a. Units + stats. Gives us a variety of towers with tradeoffs

- Tradeoffs important! Not interesting if they can only improve.



Example of stats



spend
upgrade
point

Increase
attack speed

→ Good against fast enemies

→ Bad against strong enemies

Increase
damage
per attack

→ Good against strong enemies

→ Bad against fast enemies

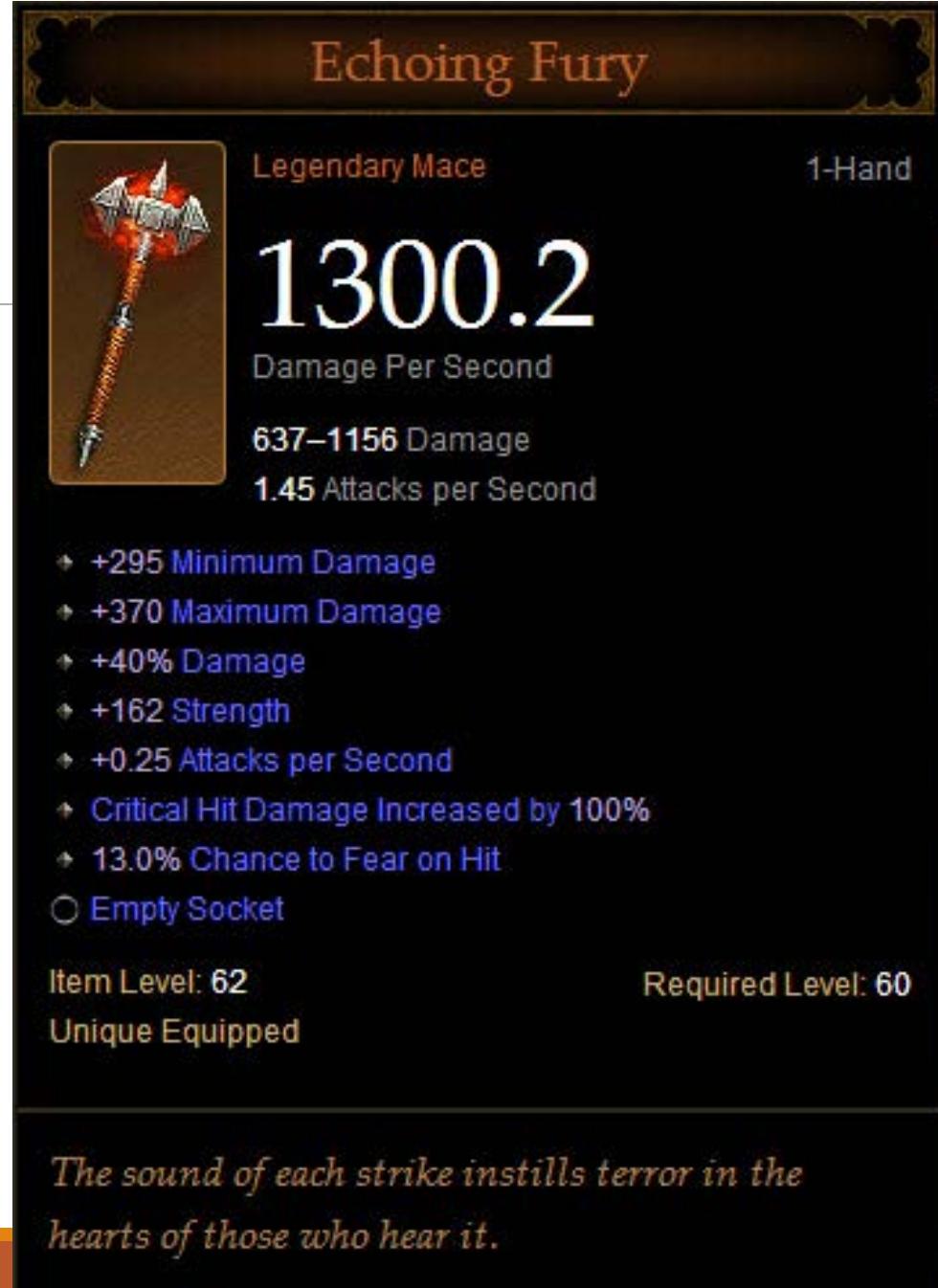
Heal damaged
unit

→ Mediocre against all enemies

Units + stats

Many stats with many benefits / drawbacks
Complex multi-dimensional optimization space

(Fun? What kind of fun?)



Example: Tower Defense

1b. Money. Resource that can be used to get what you want:

- Buying towers (buying units)
- Buying powerups (improving stats)
- Buying unlocks (buying futures on units)
- Making new towers (crafting or tech tree)



Resources / currencies

Different resource types with different properties add a lot of flexibility to the game

Resource management is a fun, hard thing for the player



Example: Tower Defense

1c. Board space is a limited resource.

Placement matters.
Location is strategic.

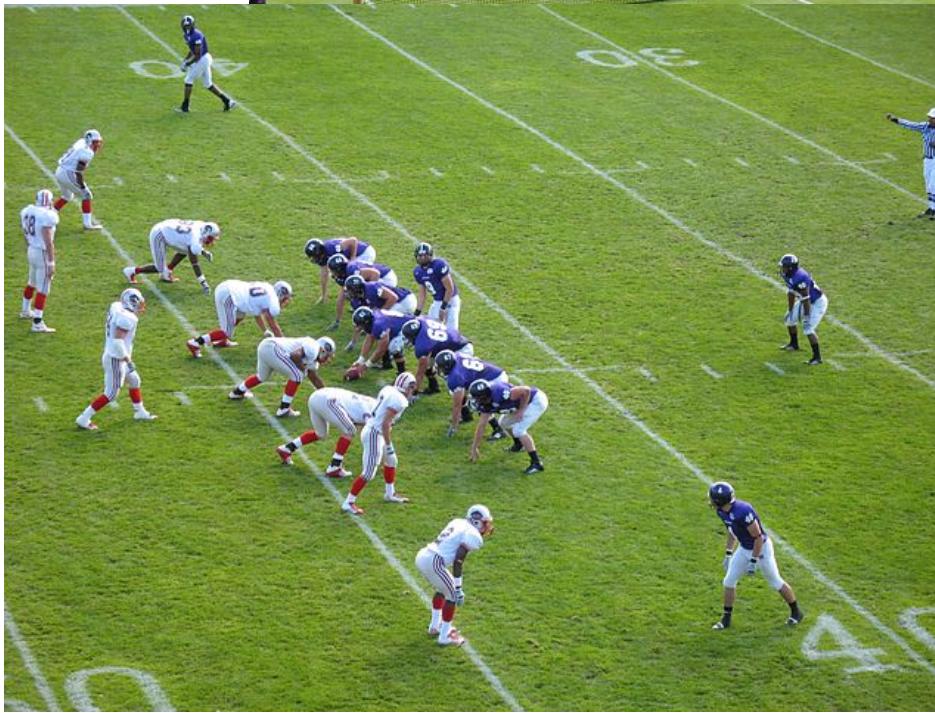
In this game, board space control
is a **victory condition**



Board + space

Possession

Control



Space as a resource



Can we consume space?

Can we convert it to other resources?



Example: Tower Defense

2. Uncertainty

- Randomized enemies
- Tower accuracy

Reasonable unpredictability!

- Not completely chaotic
- Not predictable, either
- Must fit the player's mental model of the game



Uncertainty

Other types of uncertainty:

- Randomness
 - Player Performance
 - Hidden Information
- ... we'll discuss this in detail
in a few minutes



Example: Tower Defense

3. Progression and difficulty

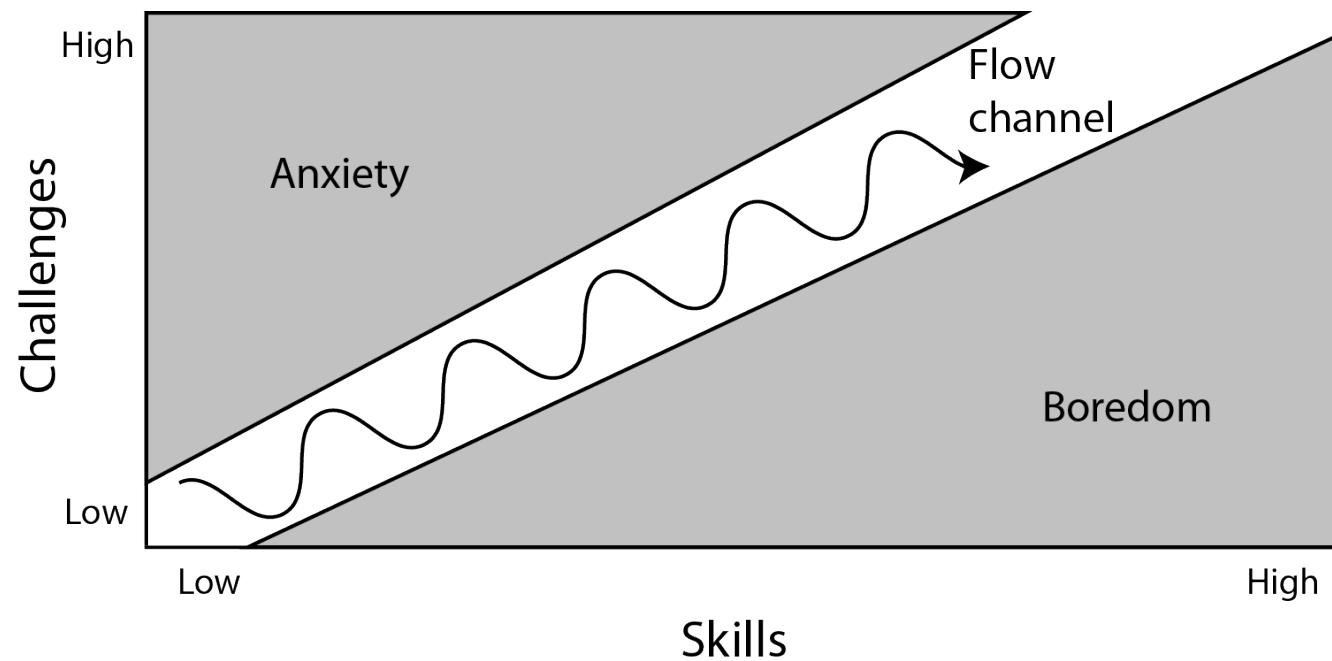
- Player learns how to play the game
- Increase challenge (how?)
- Give feedback on progress (eg. as level #)

We'll talk more about the sense of progression later on...



Difficulty

See “Flow Theory” (Mihaly Csikszentmihalyi)



4. Action mechanics



Reaction time

- because the other guy will act quickly

Timing

- slower attacks need to be “wound up” early

Time pressure

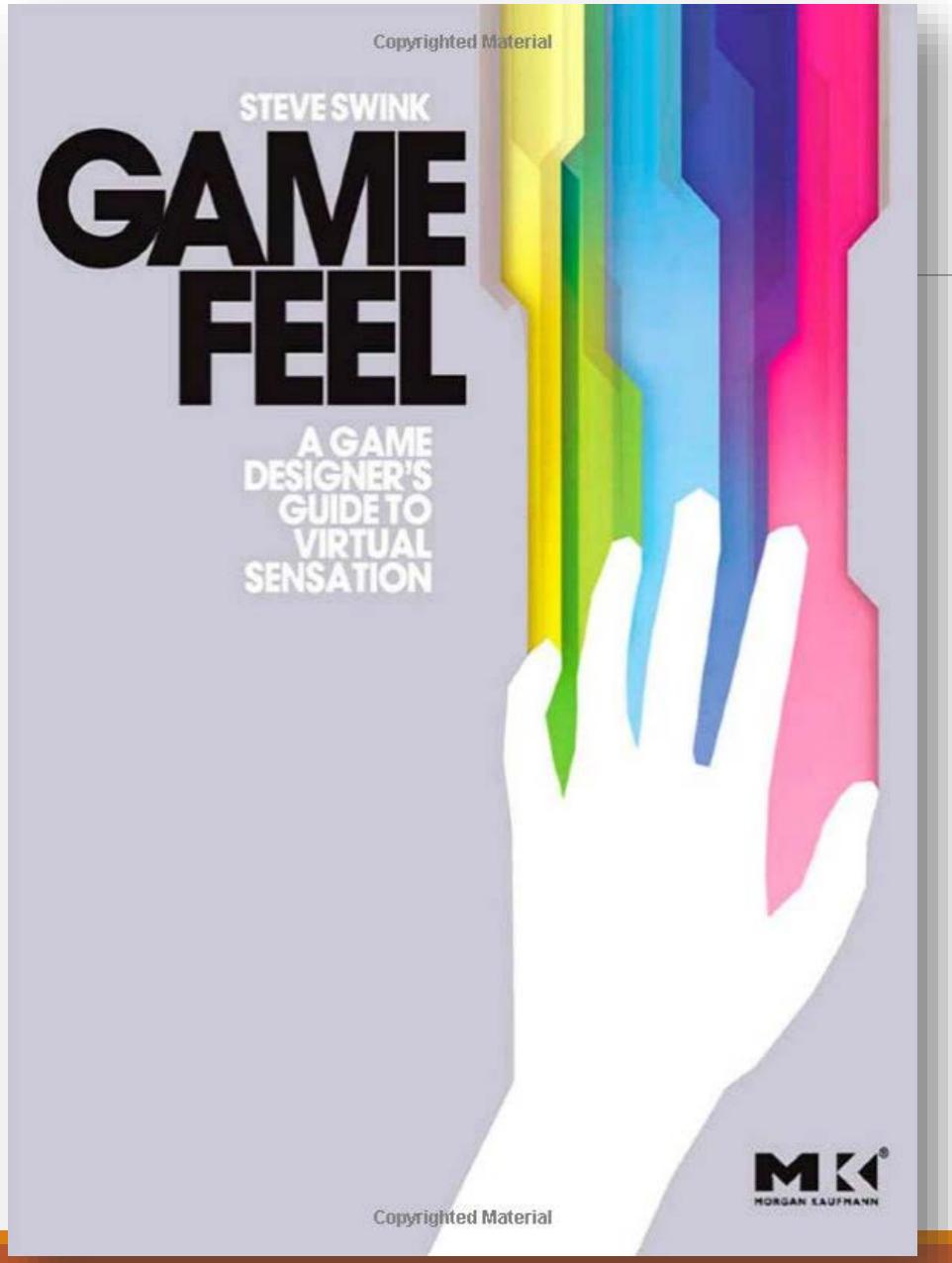
- stunned opponent creates a short window of opportunity

Precision

- combos need to be performed exactly

Avoidance

- must be able to quickly block or pull back if needed



Reaction time

- because the other guy will act quickly

Timing

- slower attacks need to be “wound up” early

Time pressure

- stunned opponent creates a short window of opportunity

Precision

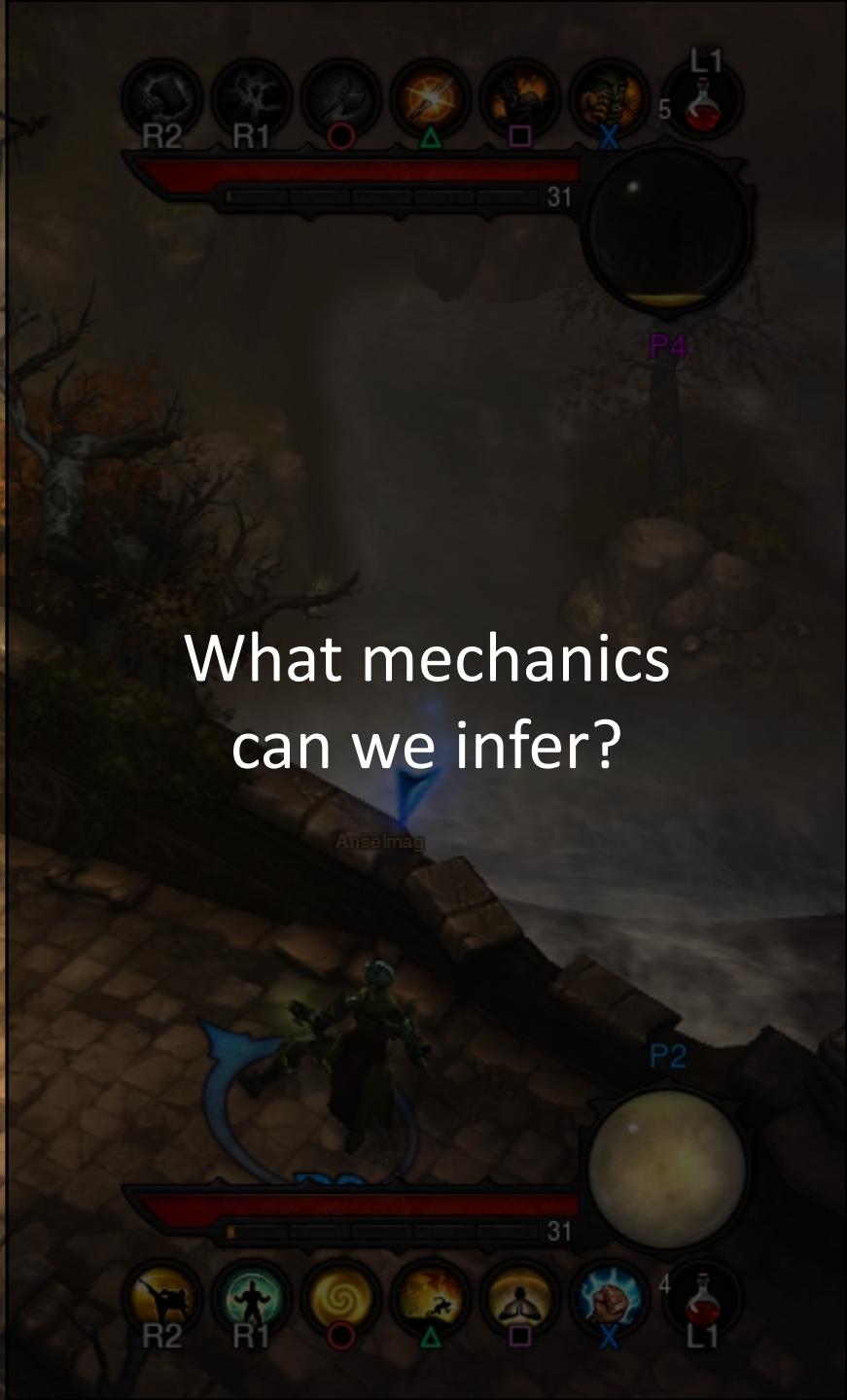
- combos need to be performed exactly

Avoidance

- must be able to quickly block or pull back if needed

Mechanics

1. Resource management
2. Uncertainty
3. Progression
4. Action
5. ... AND MANY MORE :)
 - There are many more mechanics (esp. genre-specific ones)
 - Encyclopedic coverage would be 1. difficult and 2. boring



What mechanics
can we infer?

Uncertainty MX



UNCERTAINTY IN GAMES
Greg Costikyan

playful^{THINKING SERIES}

Why uncertainty?

Costikyan:

Games are a ritualization of play

Uncertainty is a necessary component of both play and games

- If the game is predictable, we lose interest

Interactivity is also necessary for games

- Just rolling dice is not interesting
- We need two or more parties **affecting the state** for each other

These two show up in **virtually all types of games**

TWO NOTES:

1. **UNCERTAINTY != RANDOMNESS**
2. **NECESSARY BUT NOT SUFFICIENT**

16 Examples

1. Super Mario Brothers



Performative uncertainty
◦ *“How do I make that jump?”*

2. Curse of Monkey Island



Solver's Uncertainty

- “*How do I solve this puzzle?*”

3. Garden of Time

Perception Uncertainty

- “Can I find what I’m looking for quickly enough?”



4. FPS Deathmatch

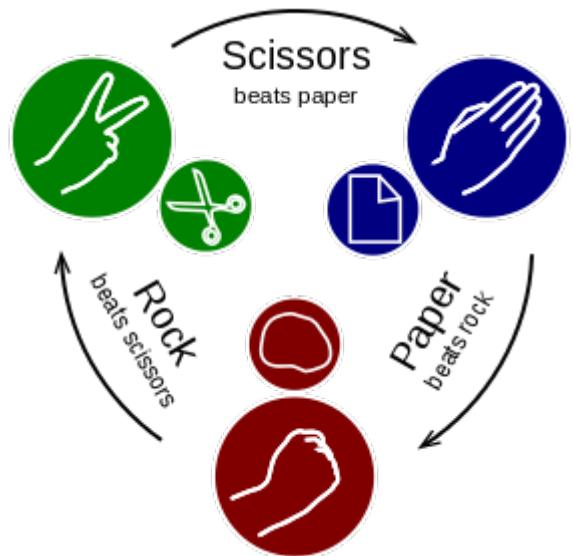
Player Unpredictability

- *“What is my enemy going to do?”*

Performance Uncertainty



5. Rock Paper Scissors



Player Unpredictability

6. Diplomacy



Player Unpredictability

Hidden Information

- “*There are important parts of this game that I don’t know about*”

7. Monopoly



Randomness

- “*What will the dice roll give me?*”

Player Unpredictability (some)

8. Chess

Player Uncertainty

Analytical Complexity

- *“The best move is really hard to figure out”*



9. Roller Coaster Tycoon



Analytical Complexity (rules of simulation)

Hidden Information (rules of simulation)

Randomness

10. Roulette

Randomness – stationary

- “*What will the random process give me?*”

Player Unpredictability



11. Poker

Randomness – **non-stationary!**

- “*What’s the probability of next cards given the cards we’ve seen so far?*”

Player Unpredictability

Hidden Information



12. Rogue-likes



Procedural Generation from Randomness
Performative Uncertainty

13. CityVille

Real-Life Uncertainty

- “Can I make this game fit my real life schedule?”

Game Evolution

- “How can I best prepare myself for how this game will change over time?”

Player Unpredictability

Hidden Information



14. Memoir '44

Randomness

Solver's Uncertainty

Analytic Complexity

Hidden Information



15. Civilization V

Hidden Information

Randomness (via proc gen)

Player Uncertainty

Analytic Complexity



16. Magic: the Gathering



Player Unpredictability
Analytic Complexity
Hidden Information
Randomness
Game Evolution

catching breath

Costikyan:

Much of the fun in games
comes from mastering uncertainty

	Super Mario	Curse of Monkey Island	Garden of Time	FPS Deathmatch	Rock Paper Scissors	Diplomacy	Monopoly	Chess	Roller Coaster Tycoon	Poker	Roulette	Rogue-likes	CityVille	Memoir '44	Civilization 5	Magic the Gathering
Performance Uncertainty	y		y									y				
Solver's Uncertainty		y											y			
Perception Uncertainty			y													
Player Unpredictability				y	y	y	y	y	y	y	y	y	y	y	y	y
Randomness - stationary					y	y	y	y	y	y	y	y	y	y	y	y
Randomness - non-stationary						y	y	y	y	y	y	y	y	y	y	y
Analytic Complexity						y	y	y	y	y	y	y	y	y	y	y
Hidden Information					y		y	y	y	y	y	y	y	y	y	y
Narrative Anticipation		y	y									y				
Game Evolution												y		y		y
Real Life Uncertainty												y		y		y

Harnessing Uncertainty

1. Player's own skill

- Performance Uncertainty
- Perception Uncertainty
- Solver's Uncertainty

Solutions

- Player masters by learning and training
- Provide difficulty levels and a learning curve

Harnessing Uncertainty

1. Player's own skill

2. Other players

- Player Unpredictability
- Includes both humans and AI

Solutions

- Player masters by figuring out their opponents
- Provide ways to observe what other players are doing, verbs for interacting with them

Harnessing Uncertainty

1. Player's own skill

2. Other players

3. Randomness

- Stationary – always same probabilities
- Non-stationary – changes as you play

Solutions

- Player masters by figuring out distributions and/or how the distribution changes
- Make this knowledge strategically important
- Also easy way to inject some dramatic tension

Harnessing Uncertainty

1. Player's own skill

2. Other players

3. Randomness

4. Complexity

- Analytic complexity – “how does this work?”
- Hidden information – “what’s out there?”

Solutions

- Player masters by experimenting, exploring, building a mental model of the world
- Give the player different ways to explore and learn about the game

Harnessing Uncertainty

1. Player's own skill

2. Other players

3. Randomness

4. Complexity

5. Anticipation

- Narrative anticipation
- Game evolution
- Real life effects

Solutions

- Player enjoys trying to anticipate the future and then seeing how their predictions turned out
- Make the future non-obvious, but logically flow from the present

Harnessing Uncertainty

1. Player's own skill
2. Other players
3. Randomness
4. Complexity
5. Anticipation

Consider these when you
plan your final project...

Homework

EOD Sunday Jan 21 (11:59pm)

- Read all lecture notes through the end of chapter 5
- Do all exercises from lecture notes chapters 3, 4, 5

Also start thinking about your game project