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# Game Design & Development Mechanics + Balancing

# Game Mechanics



# Mechanics

- The **core** of what games truly are
- Taxonomies incomplete
  - Complex mechanics even for simple games
  - Since they act on mental models, they are difficult to analyze

# Mechanics Categories

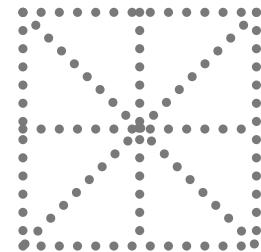
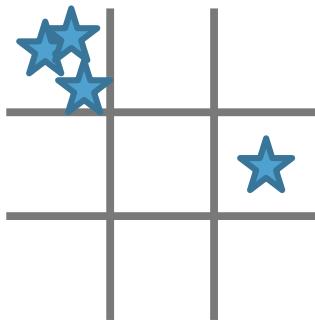
6 Main Categories:

1. Space
2. Objects
3. Actions
4. Rules
5. Skills
6. Chance

# 1. Space

- Where games take place
- Characteristics
  - Discrete or continuous
  - Some number of dimensions
  - Bounded areas, connected or not
- Aesthetics can give a distorted perception of space!
- A game can **mix** or **nest** several space models

# Space in games



**Tic Tac Toe**  
Discrete space, adjacency

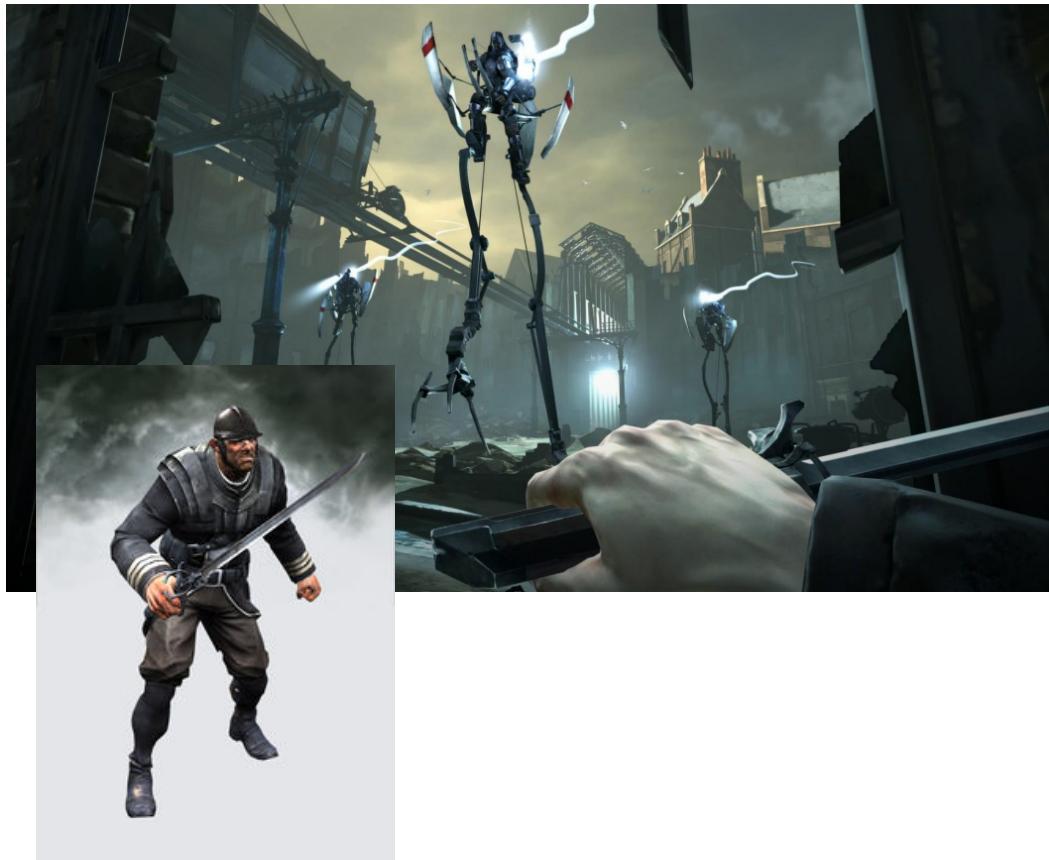


**PES 2016**  
Continuous space, bounded

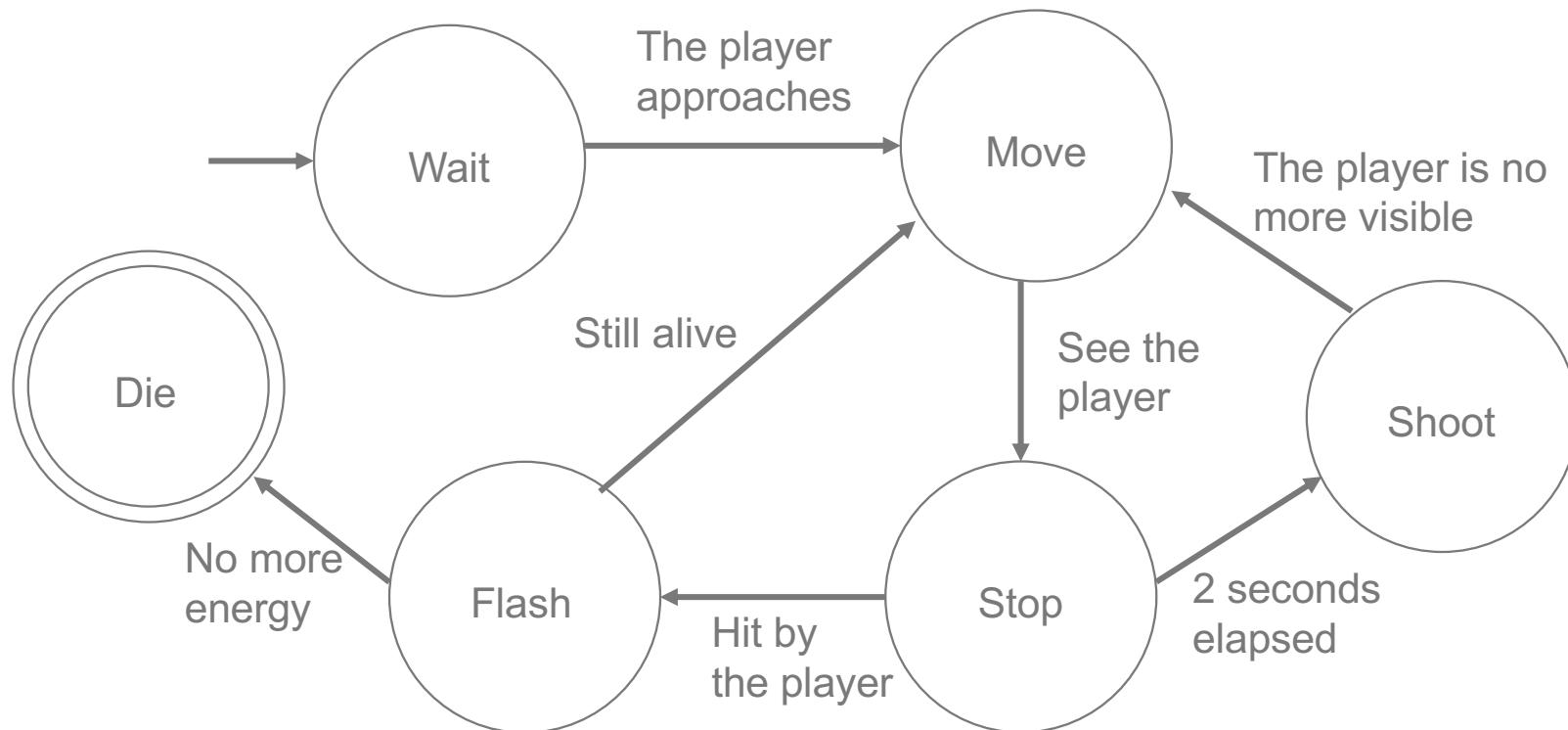
# 2. Objects

- Objects
  - Characters, props, scoreboards, and so on
- Different objects imply different appearance
- Objects have **attributes** (e.g. position, color) in a **state** (the current value)
  - Visible or hidden to the player
- State machines useful to represent attributes and states!

# Dishonored



# The enemy starship behavior



## 3. Actions

- “What can the player do?”
- Operative actions (“verbs”)
  - Move
  - Jump
- Resultant actions (in the picture of the game)
  - Most of them are not part of the rules, strategic
  - Make a noise... to force the enemy to uncover, fix the enemy... to flank him

# Metal Gear Solid 5



# Emergent gameplay

- Elegant, but need care
- Creating interesting resultant actions
  - More operative actions [but useful]
  - Verbs acting on many objects
  - More ways to achieve a goal
  - Many subjects, e.g. the specialists of Commando
  - Side effects changing constraints, see checkers
- Innovative games: new actions!

# 4. Rules

- Most fundamental mechanic
- Rules enable the other mechanics and add goals

# Parlett's rule analysis (1-4)

1. Operational rules
  - Describe what players do to play
2. Foundational rules
  - Underlying formal structure of the game
  - Ex. After an action, player's power increases by a value between 1 and 10
3. Behavioral rules (or “unwritten rules”)
  - Sportmanship
4. Written rules
  - The document
  - In modern videogames, replaced by more effective tutorials

# Parlett's rule analysis (5-8)

5. Laws or “tournament rules”
  - Competitive settings
  - Clarify or modify standard written rules
6. Official rules
  - Merge written rules and laws
  - Over time they become written rules
7. Advisory rules or “rules of strategy”
  - Hints to play better
8. House rules
  - Flexible player’s rules

# Rules Integration

- Modes
  - Too many modes confuse the users
  - Players have always to know the current mode
- Traditional written or spoken rules become physical laws in videogames world
- The most important rule: the goal
  - Concrete
  - Achievable
  - Rewarding

# Far Cry 3



# 5. (Player's) Skills

- Related with players and flow channel
- Main categories
  - Physical: strength, dexterity, coordination, etc.
  - Mental: memory, observation, puzzle solving.
  - Social: “anticipation”, fooling, coordination, etc.
- Different from virtual skills (e.g. your avatar)
  - Feeling of power for the player
  - Player's skills can augment at the same time or not

# Unravel



# 6. Chance

- Chance = uncertainty = surprise!
- Probability
  - look at **probability distribution curve**!
- Practical probability often more useful than theoretical
  - Monte Carlo Method
- Use **expected value** to determine winning, balanced and losing (sub-)games
  - Use the **real expected value** to verify the real value of your actions
  - Expected value does not perfectly predict human behavior
  - Take into account the perceived probabilities

# Skills and chance are coupled

1. Estimating chance is a skill
2. Skills have a probability of success
3. Estimating an opponent's skill is a skill
4. Predicting pure chance is an imagined skill
  - humans look for imaginary patterns
5. Controlling pure chance is an imaginary skill
  - Superstition, rituals, etc.

# Game Economy



# Internal Economy

- An economy is a system in which resources are produced, consumed, and exchanged in quantifiable amounts.
- In games, the internal economy can include all sorts of resources that are not part of a real-life economy (NOT just money).

# Elements of Internal Economies

- Resources
- Entities



# Resources

- Refer to any concept that can be measured numerically. Almost anything in a game can function as a resource.
- All economies revolve around the flow of resources.
- Anything the player can produce, gather, collect, or destroy is probably a resource of some sort, but not all resources are under the player's control.

# Types of Resources

- **Tangible or intangible:** if they have physical properties (e.g., occupy space and can be moved).
- **Abstract or concrete:** abstract resources do not really exist in the game (player cannot see them) but are computed from the current state of the game (internal logic).

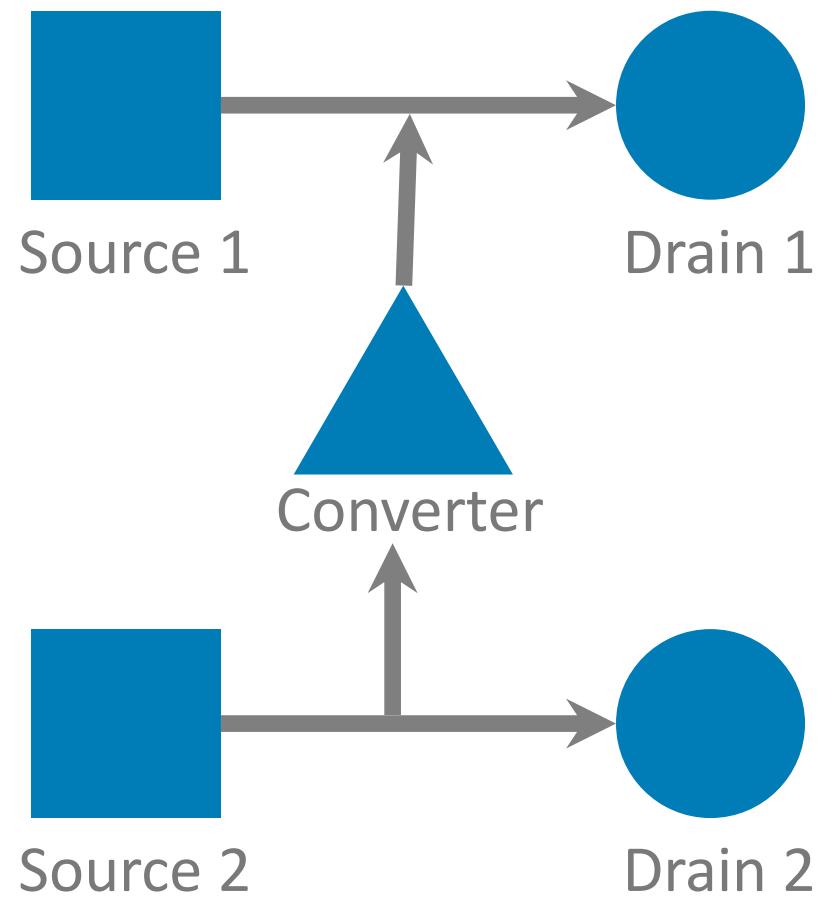
# Entities

- An entity stores a specific amount of a resource. (a *variable*)

# Four Economic Functions

- **Sources** are mechanics that create new resources out of nothing. They may be triggered by events in the game, or they may operate continuously, producing resources at a certain production rate
- **Drains** take resources out of the game, reducing the amount stored in an entity and removing them permanently.
- **Converters** turn resources of one kind into another.
- **Traders** are mechanics that move a resource from one entity to another, and another resource back in the opposite direction, according to an exchange rule.





# Game Balance



# Game Balance

- Balance is the concept and the practice of tuning a game's rules, usually with the goal of preventing any of its component systems from being ineffective or otherwise undesirable when compared to their peers.

Source: [https://en.wikipedia.org/wiki/Balance\\_\(game\\_design\)](https://en.wikipedia.org/wiki/Balance_(game_design))

# Game Balance Types

Types:

1. Fairness
2. Challenge Vs Success
3. Meaningful Choices
4. Skill Vs Chance
5. Head Vs Hand
6. Competition Vs Cooperation
7. Short Vs Long
8. Rewards
9. Punishment
10. Freedom Vs Controlled Experience
11. Simple Vs Complex
12. Detail Vs Imagination

# Type 1: Fairness

- Symmetrical games
  - Equal resources and powers to all players
  - Good to determine the best player
- Asymmetrical games
  1. Simulation of a real situation (e.g. WWII)
  2. Different ways to explore a game
  3. Personalization
  4. Level opposing forces
  5. Interesting situations

# Evolve



# Balancing Asymmetrical Games

- A value to each resource (power, skill, etc.) and equal sum of the values or
  - Theoretical: verify by playtesting

Plane	Speed	Shields	Fire	Total
1	High 6	Low 1	Medium 2	9
2	Medium 4	Medium 2	Medium 2	8
3	Low 2	High 3	High 3	8

2X because very important value (estimated during an evaluation)

- Intransitive relationships (“Rock, paper, scissors”)

# Type 2: Challenge Vs Success

- Cf. flow channel!
- Techniques
  - Increase difficulty after each success
  - Let players get through easy parts fast
  - Create “layers of challenge”
  - Let players choose the difficulty level
  - Playtest with a variety of players



# Resident Evil Revelations



# Type 3: Meaningful Choices

- Choices must have a real impact on the game
- Dangers:
  - 50 cars without driving differences
  - 10 guns, but 1 clearly better (**dominant strategy**)
- Many **dominant strategies** in the beginning of the development
- **Triangularity:** the player has to choose between a low or high risk for a low or high reward

# Type 4: Skill Vs Chance

- The balance depends on players' tastes
  - But also age, gender, culture, etc.
- Alternate the use of skills and chance
  - Handing out a card is chance
  - How to play it is skill

# Type 5: Head Vs Hand

- Games can alternate or even involve simultaneously problem solving and dexterity
  - E.g. action platform like Castlevania
- Announce clearly this balance in your game
  - PacMan II was unsuccessful: puzzle game associated with a Sonic-like appearance



# Type 6: Competition Vs Cooperation

- Basic instincts
- In videogames, more competition
- Competition and cooperation can coexist
  - E.g. for getting bonus!
  - Joust, Hokuto no Neko: the player decides how to play
  - Teams competition



# Type 7: Short Vs Long



- Too short games
  - Players may not develop meaningful strategies
- Too long games
  - Sometimes boring
  - Demand too much time
- Altering win conditions influences the length
  - Spy Hunter
- Change gameplay after some times
  - Minotaur, Bomberman, Bubble Bobble

# Type 8: Rewards

- People want to be judged favorably
- Common rewards (sometimes combined):
  - Praise (e.g. the sounds in Nintendo games)
  - Points (achievements XBOX, PS3, Steam, etc.)
  - Prolonged play (e.g. Pinball, extra lives)
  - Gateway (e.g. Mario's secret levels)
  - Spectacle
  - Expression (e.g. special cloths)
  - Powers (e.g. Resident Evil 5 weapons)
  - Resources (virtual money, food, etc.)
  - Completion
- How to balance them
  - Increase the value of rewards as the player progresses
  - Variable rewards

# Type 9: Punishment

- Games are supposed to be fun, but
  - Punishment create endogenous value
  - Taking risk is exciting
  - Punishments increase challenge
- Common punishments
  - Shaming (opposite of praise)
  - Loss of points
  - Shortened play (e.g. losing a life)
  - Game over
  - Setback (back to a checkpoint or to the start)
  - Removal of powers (temporal is often better)
  - Resource depletion (e.g. money, ammos, etc.)
- **Reward more effective than punishment, but...**

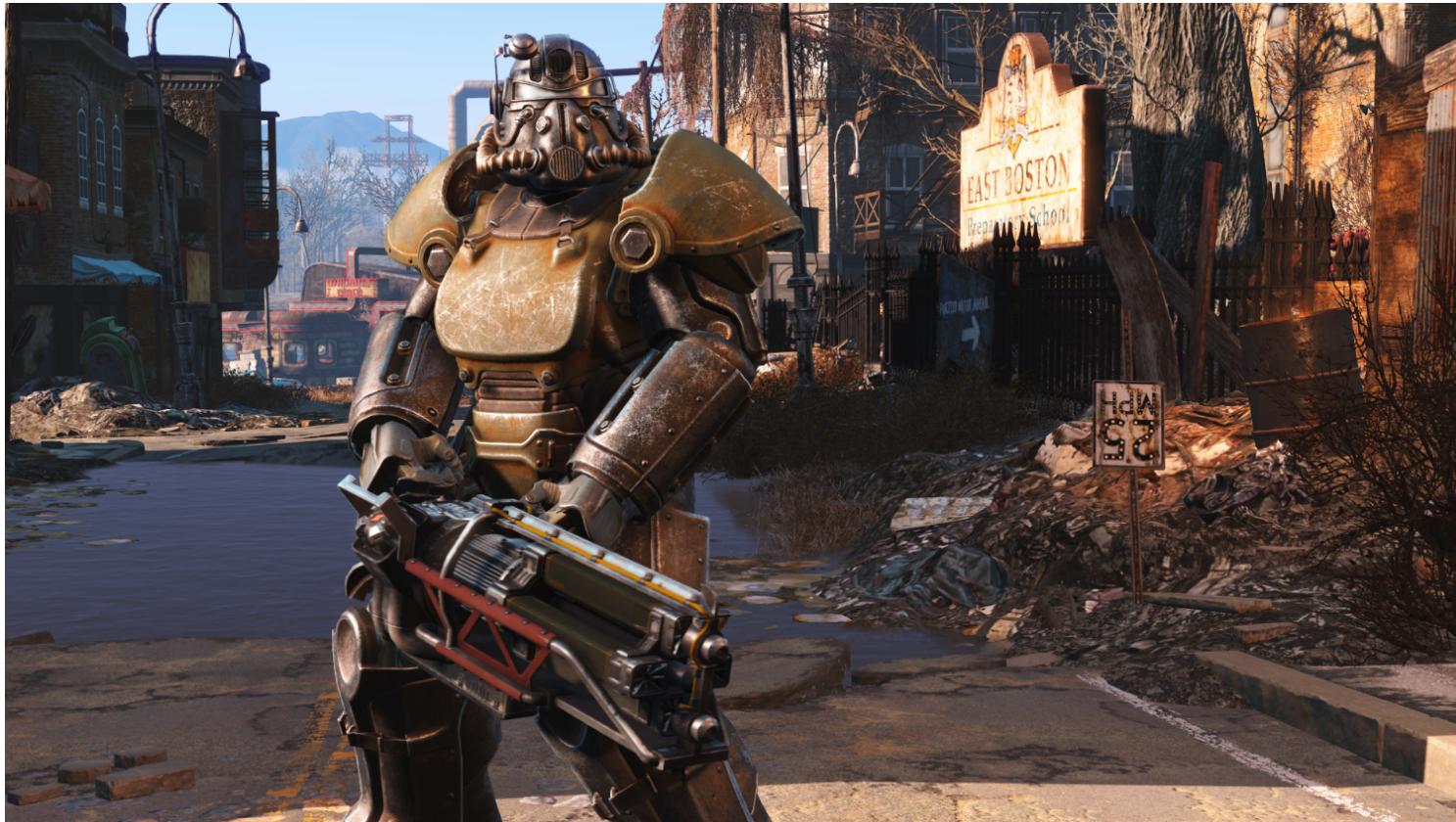
# The Banner Saga & Dark Souls



# Type 10: Freedom Vs Controlled Experience

- Control over everything can be boring for players and complex for designers
- Where to give player freedom?
- How much?
- Freedom is expensive
  - GTA 5, Red Dead Redemption

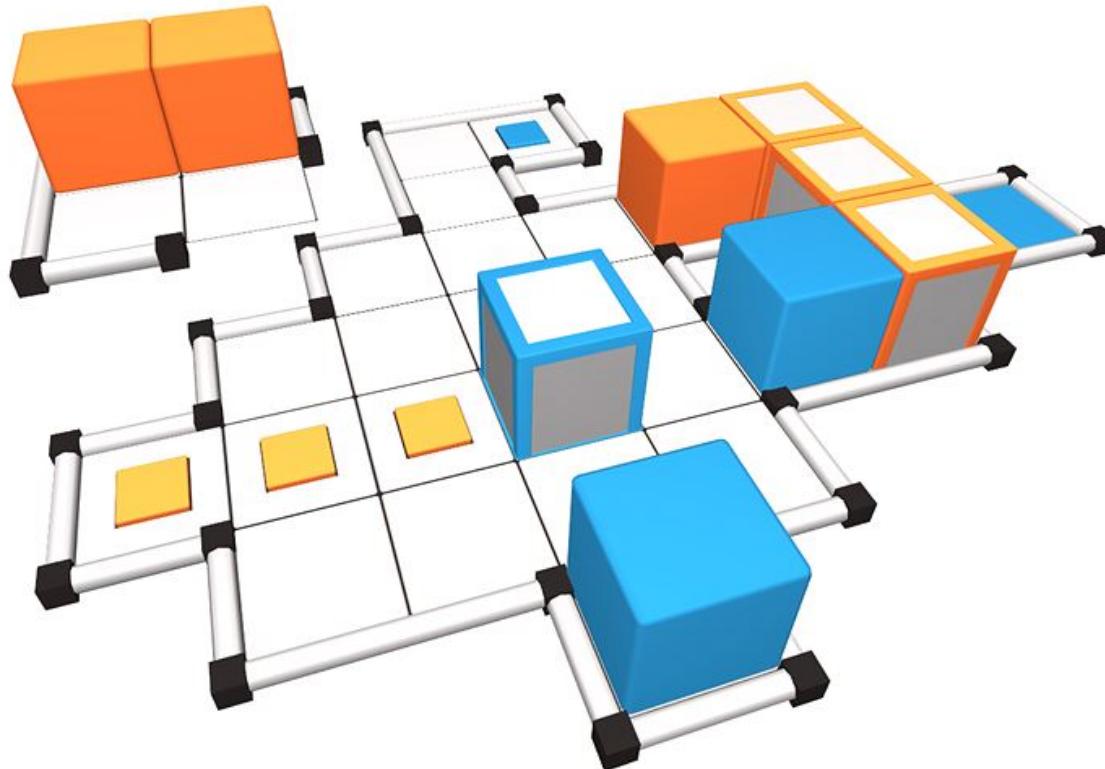
# Fallout 4



# Type 11: Simple Vs Complex

- Innate complexity: very complex rules
  - Simulations
  - “artificial balancing”
- Emergent complexity
  - Praised by everyone
- “Elegance” (simple systems performing well in complex situations)
  - Remove elements with only 1 or 2 purposes
- Character
  - Can mitigate the elegance (think at the tower of Pisa)

# Cubot



# Type 12: Detail Vs Imagination

- Only detail what you can do well
- Give details the imagination can use
- Familiar worlds do not need much detail
- Use the binocular effect
  - Spectators in theatre mostly look actors at beginning
- Give details that inspire imagination

# Diablo 3



# Game balancing methodologies

- A general method does not exist
- State your problem
- “Doubling and halving” instead of fine tuning
- Train your intuition
- Document your model
- Tune your model as you tune your game
- Plan to balance (even in real-time)
- Let players do it (in general, to avoid)

# Balancing Game Economies

- How will the player earn money?
- How will the player spend it?
- Money can also be skill points
- Similar to balance any other mechanic of the game

# Dynamic Game Balancing

- Dream: adapt the game to player's skills on the fly
- Problems
  - It spoils the reality of the world
  - It is exploitable by players
  - Players improve with practice

# Wrap Up (Exam)

- 6 mechanics categories
- Game economy
- 12 types of game balance