# Mechanism Design

Aaron Soskin
Govrn | Founder

# Who is Aaron

Born in Bay Area, but grew up in Sacramento

Wanted to be an astronaut when I grew up

Previous jobs:  Management Consultant, Dairy Farmer, Production Assistant

Love Skiing, Concerts, and the SF Giants

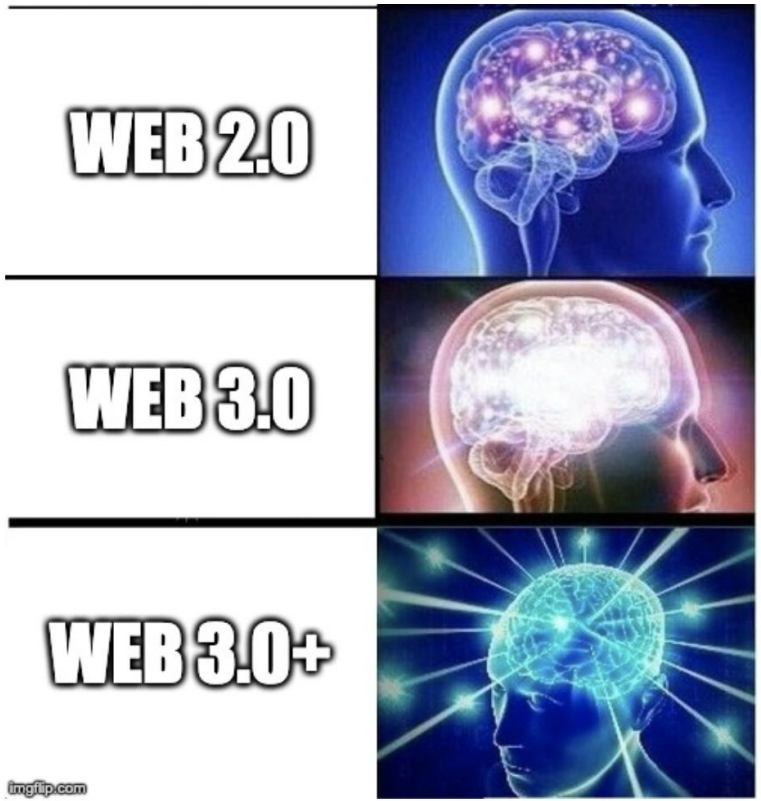
Got into Blockchain about 3.5 years ago

**Hot Take:** Ranch dressing is the best food pairing condiment

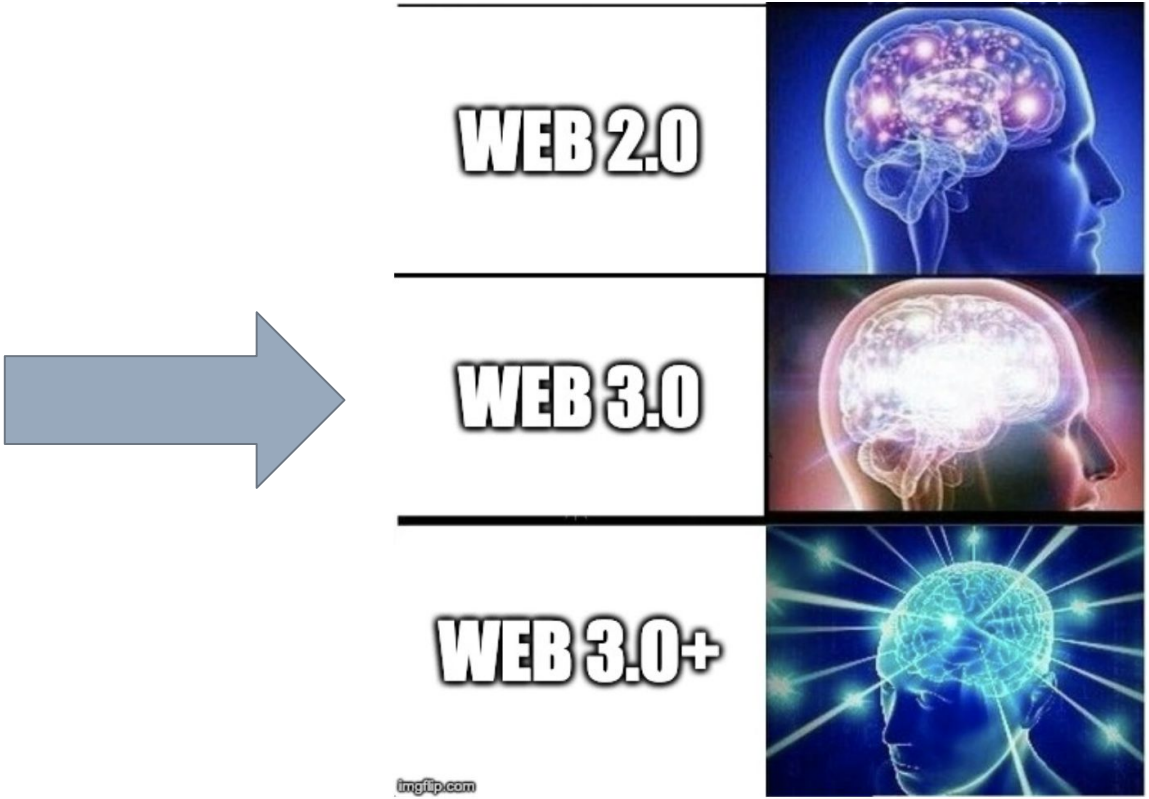
# Agenda

1. Game Theory
    a. Intro Teaser
    b. Prisoners Dilemma
        i. Mafia Example
2. Mechanism Design
    a. Coordination:  Sub - Game Perfect Equilibrium
        i. Second Hand Ticket Example
    b. True Price:  Auctions
        i. Why different auctions are helpful
    c. Governance / Politics / Voting
        i. Quadratic Voting
        ii. Govrn

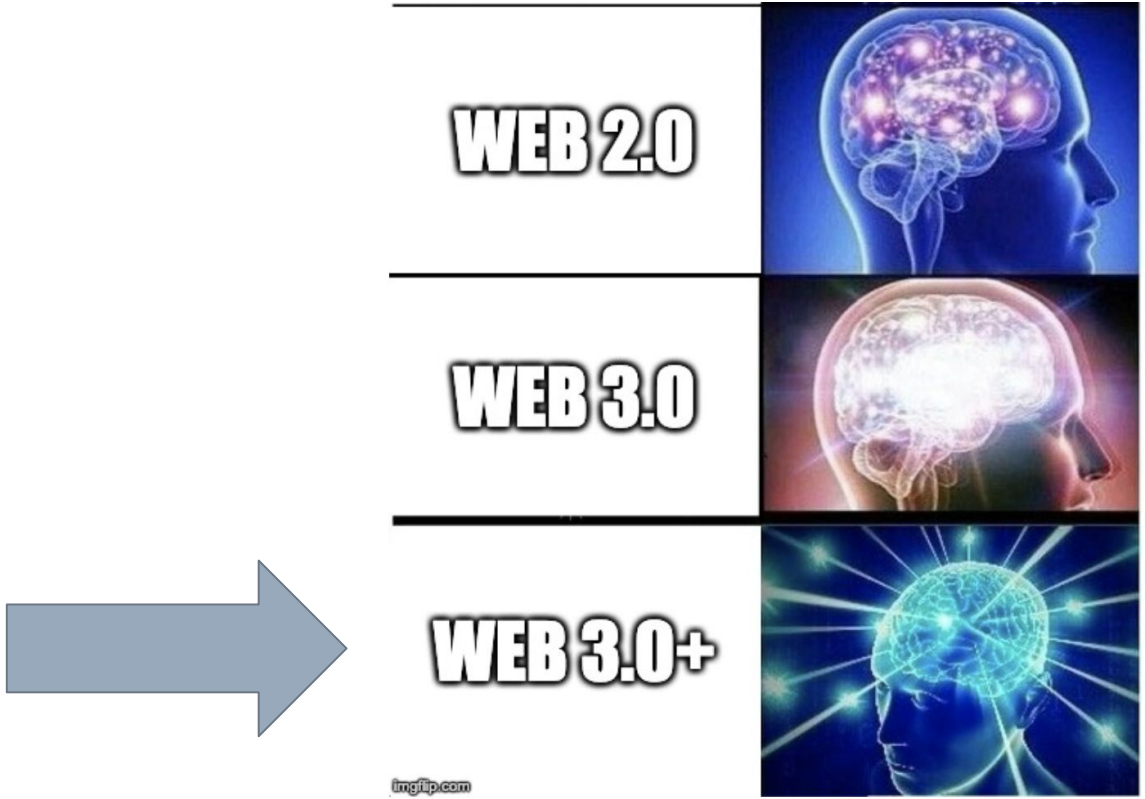
# Model for thinking of Web 3



# A lot of Crypto Projects are here



# My goal for this talk



# Acknowledgements

Joshua Gans
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Steve Tadelis
*Professor at UC Berkeley*

Kevin Bryan
*Asst Professor at University of Toronto*

# Teaser on Game Theory

- Everyone pick an integer (whole number) between 0 and 20 *
- We are going to take everyone's number and compute the average
- The person who guesses the number that is closest th 75% of the average wins a prize

- Use the QR Code to the right to submit your number

https://forms.gle/om8rezq5pQ4SJost5

** Acknowledgement to Professor Steve Tadelis for teaching me this teaser (P-Beauty Contest)*

# Teaser on Game Theory

Things to consider:

- What’s the max number the average could be:

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- What's the max number the average could be: **15**
- This means a rational player would never guess more the 15
- If everyone is rational, what does that mean we should guess?
- If everyone is rational - we should all guess **0 or 1**

https://forms.gle/om8rezq5pQ4SJost5

# Teaser on Game Theory

The **smart** answer might by 0 or 1, but it's not the **right** answer

Not everyone thinks rationally all the time, but a lot of people do most of the time

What's the right balance between **smart** and **right**

# Difference between Game Theory and Mechanism Design

## Game Theory

Game theory is the tool to understand people's incentives and how they react to each other

## Mechanism Design

Mechanism Design is the tool on how to design optimal algorithms to a given game theory

# Difference between Game Theory and Mechanism Design

# Prisoner Dilemma

# Prisoner's Dilemma

| Prisoner B / Prisoner A | **Prisoner B stays silent (*cooperates*)** | **Prisoner B betrays (*defects*)** |
|---|---|---|
| **Prisoner A stays silent (*cooperates*)** | Each serves 1 year | Prisoner A: 3 years<br>Prisoner B: goes free |
| **Prisoner A betrays (*defects*)** | Prisoner A: goes free<br>Prisoner B: 3 years | Each serves 2 years |

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# So the Mafia built their own mechanism...

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2. **They changed the payoff**
    a. “Kidnap your family and break your knees”

3. **And is changed the number of times the game is played**
    a. “And the Mafia is for life.”

# Is this an Single Game or Iterative Prisoner Dilemma

Are you playing the Prisoners Dilemma once or many times

- If you're only playing once, it naturally occurs where everyone defects
- If you're playing multiple times, people naturally end up cooperating
    - Simple explanation:  "Fool me once, shame on you.  Fool me twice, shame on me"
    - Technical explanation:  Your current NPV of cheating doesn't outweigh future NPV from cooperating

Part of what we're doing at Govrn is trying to change politics from a Single Game Prisoners Dilemma to an Iterative Prisoner Dilemma

# Meme Time

# Sub-Game Perfect Equilibrium

# Example: Second Hand Ticket Sales

Reality of the situation buying tickets via Facebook

- Buyers are worried that they’re going to send money without getting tickets or that they’ll get fake tickets

- Sellers are worried that they’ll send tickets and never get a payment.

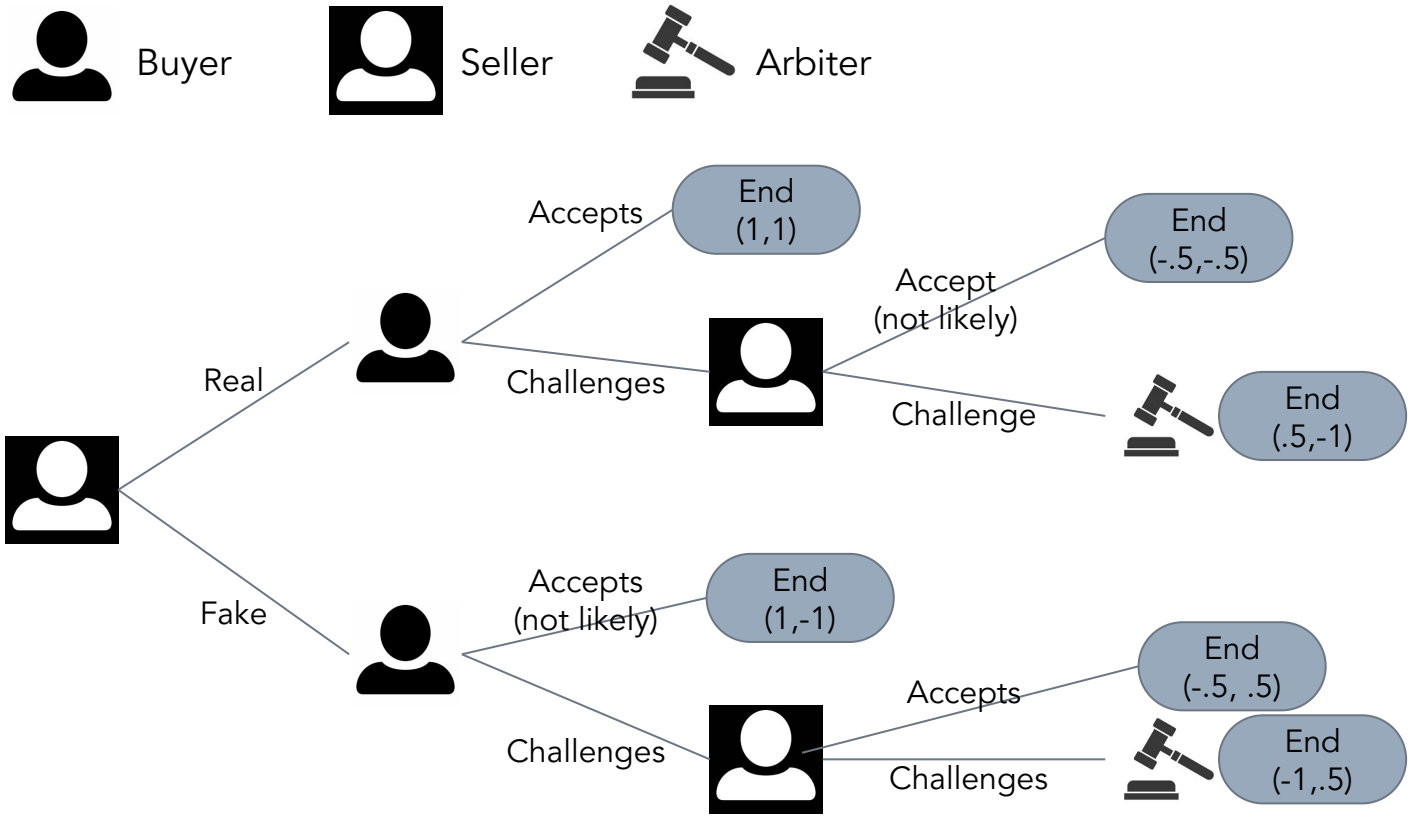
**What are the incentives behind this game?**

**What do rational players, vs nice players, vs normal players do?**

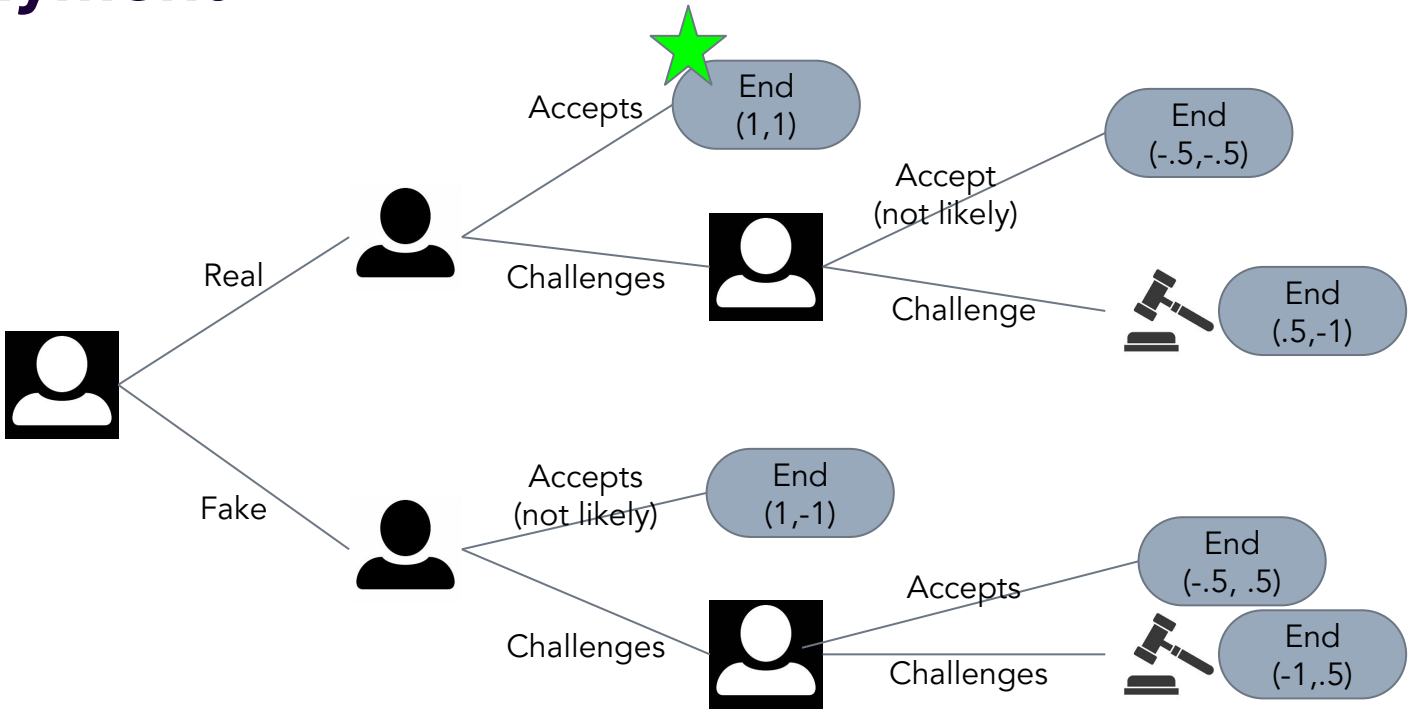
# Applying Sub Game Perfect Equilibrium

1. A seller submits ticket to smart contract and buyer submits payment to smart contract
2. Once both are submitted, the ticket goes to the buyer who has a choice. The buyer can challenge the ticket or accept the ticket (time bound challenge)
    a. If the buyer accept the ticket, the payment goes through and the seller receives the payment. The transaction (game) has ended
    b. If the buyer challenges the ticket, they have to pay 50% of the price of the ticket. The game then goes back to the seller
3. The seller can then either accept or challenge the buyers challenge
    a. If the seller accepts the challenge (meaning they agree they sold a fake ticket) then the buyer gets all their money back. The transaction (game) has ended
    b. If the seller challenges the ticket, they additionally have to pay 50% of the price of the ticket.
4. If both challenges, then the case goes to an arbiter who then decides if the ticket is real or not. The winner gets money back and losers money goes to the arbiter

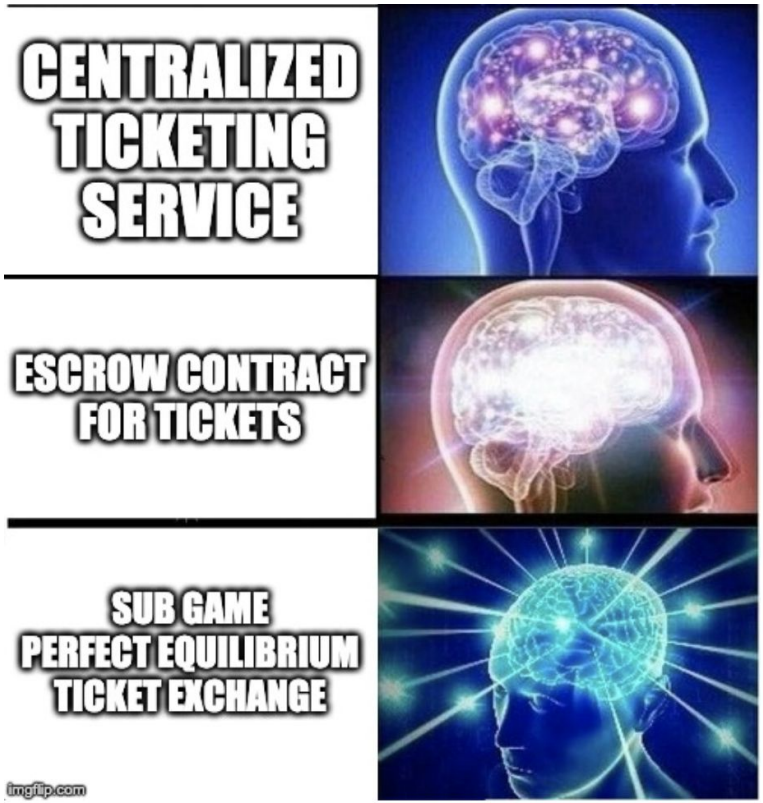
# Visual Sub Game Perfect Equilibrium



# The only scenario with the best case for both players is the one where it's a real ticket and real payment



# Meme Time


CENTRALIZED TICKETING SERVICE
ESCROW CONTRACT FOR TICKETS
SUB GAME PERFECT EQUILIBRIUM TICKET EXCHANGE
imgflip.com

# Auctions

# Different Types of Auctions

| Type | What is it |
| --- | --- |
| English Auctions (First Price) | Ascending open bids until no on outbids the current bid.<br>- Winner pays the last bid |
| Dutch Auctions (First Price) | Descending open prices until a bidder takes the price<br>- Winner pays the bid price |
| Sealed Second Price | The highest bidder wins, but only pays the amount of second highest bid. Bids are also concealed and not open<br>- Winner pays the second highest bid price |
| Vickrey, Clarkman, Grove (VCG) | Maximizes social utility by maximizing the highest combinations of what bidders are willing to pay.<br>- Winner pays the marginal price harm to other participants |

# What is a VCG Auction

All bids are sealed (kept secret)

Price paid is the marginal price harm the bid created for other players.

Each winner pays a different price

Equation:  Price for specific player = Sum of the best combination of bids if the current players bid was excluded - Sum of the other bids from actual winning bids

Incentivizes players to bid what they actually think the price is

# Example: Second Hand Ticket Sales

Reality of the situation buying tickets via Facebook

- Buyers don't want to over pay for ticket prices and only have information of what they see on a facebook event page.

- Sellers want to maximize price without price gouging (*most*), but also don't want to get stuck with the tickets they can't use.

**What are the incentives behind this game?**

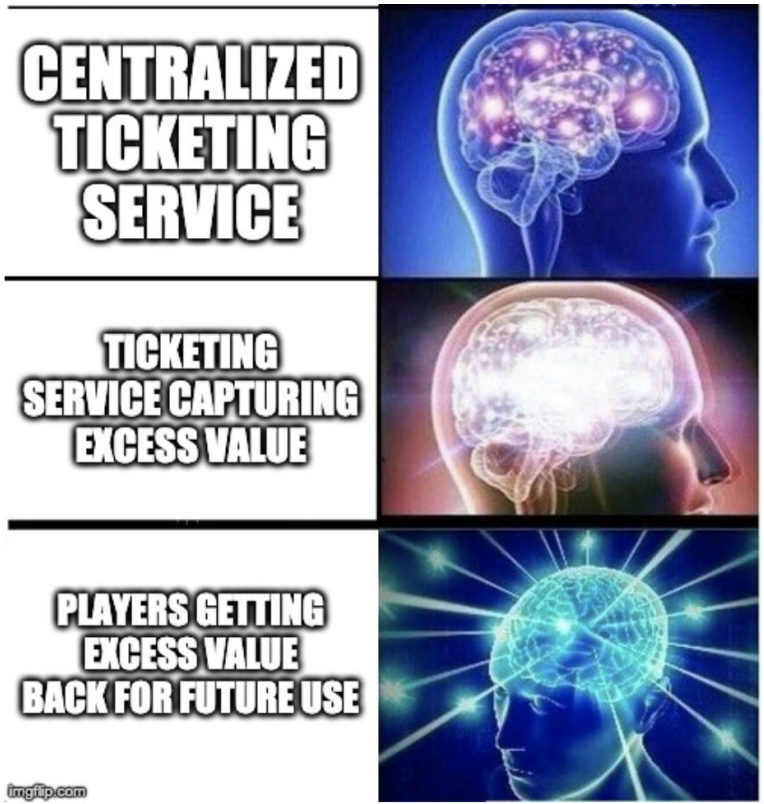
**What do rational players, vs nice players, vs normal players do?**

# Applying a VCG Auction/Mechanism

1. There are 2 concert tickets available for 3 people
2. Players:
    a. Aaron: Will pay $5 for one ticket
    b. Sarah: Will pay $2 for one ticket
    c. Lucas: Will pay $6 for both, but doesn't want any if he can't have both
3. Everyone submits their bids
4. The auction maximizes the bids: The tickets go to Aaron and Sarah for a total value of $7 (greater than the value of $6 from Lucas)
5. Payments:
    a. Aaron: $6 - $2 = $4
        i. ($6 would be the winning bid had Aaron not bid; $2 is the other winning big amount)
    b. Sarah: $6 - $5 = $1
        i. ($6 would be the winning bid had Aaron not bid; $5 is the other winning big amount)
    c. Lucas: $6 - $6 = $0 (didn't win the tickets)

Aaron and Sarah both captures a value of $1 (respectively paying $4 for $5 of value and $1 for $2 of value)

# Meme Time


CENTRALIZED TICKETING SERVICE
TICKETING SERVICE CAPTURING EXCESS VALUE
PLAYERS GETTING EXCESS VALUE BACK FOR FUTURE USE
imgflip.com

# Governance / Politics / Voting

# Quadratic Voting

**Quadratic voting** is a collective decision-making procedure where individuals allocate votes to express the *degree* of their preferences, rather than just the *direction* of their preferences.

Quadratic Voting specifically aims to solve this by making each additional vote cast cost the squared amount of the Nth vote you cast.

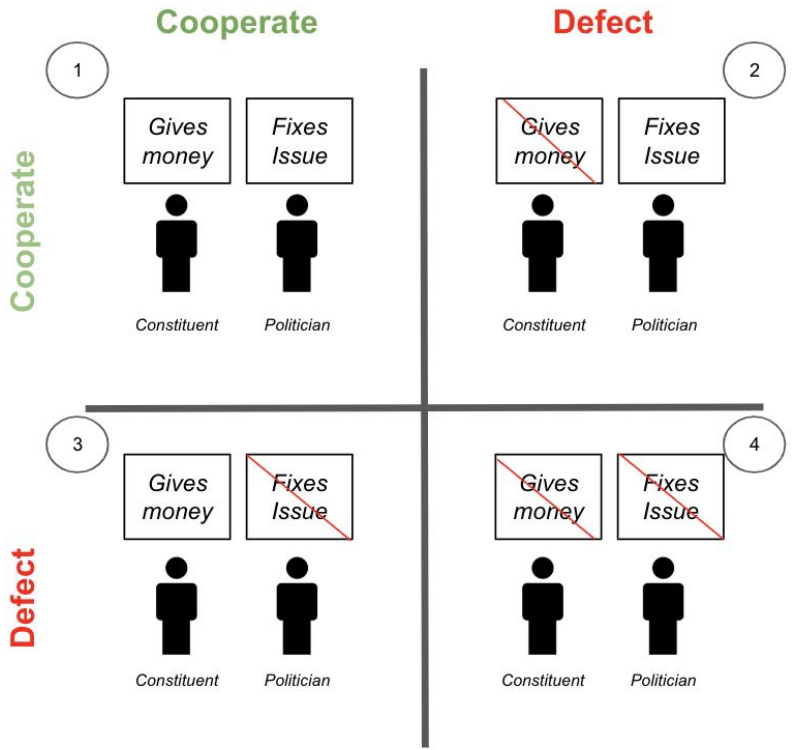
- Equation: Total Cost of Votes = (number of votes)^2

In other words, it flattens the impact higher impact players have.

| Number of votes | "Vote credit" cost |
|---|---|
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |
| 5 | 25 |

https://vitalik.ca/general/2019/12/07/quadratic.html

# Govrn’s Prisoner's Dilemma



# Govrn's Mechanism Design:
# Outcome Based Donations

OBD's are donations that are held in tech enabled escrow contracts until predefined community metrics are reached.  Once a politician reaches a metric, they receive the donation.

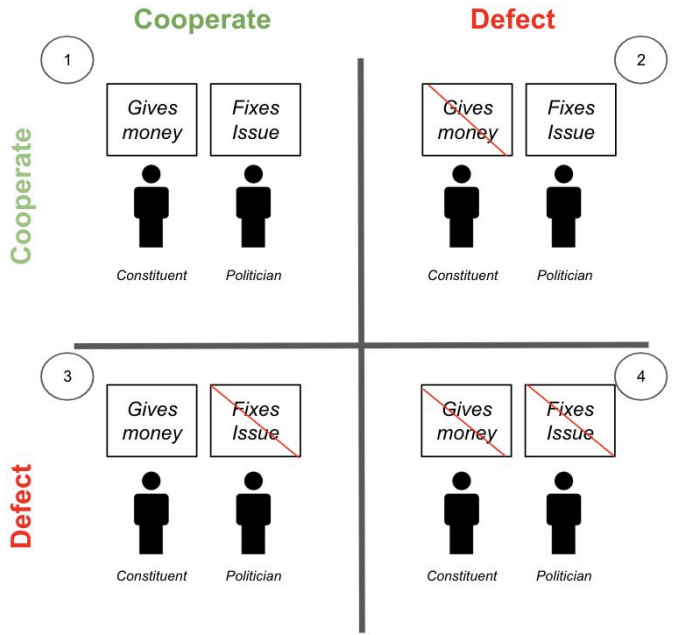
If the politician doesn't reach the metric, the donation goes to their opponent or to a non profit

# Govrn's Mechanism Design:
# Outcome Based Donations

1. Govrn is changing the probability for each option

2. Govrn is changing the payoffs for each option

3. Govrn is changing the number of times the game is played



# Why does this matter?

## This is what gets people excited

No one gets excited about a “digital ledger” or “immutability”

Everyone gets excited when they see the new world you’re creating

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# Contact Information


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