Social choice

- Concerned with **group decision making**

- **Voting:** how to combine *preferences* to derive a social outcome

Social Choice Function

- One of the variants of *preference aggregation*
  - *Selects **one** of the possible candidates (e.g. an election)*

Voting Procedures

- Examples:
  - Simple majority election (for 2 candidates only)
  - Sequential majority elections
  - Borda count
  - Alternative Vote (Instant Runoff Voting)

Desirable Properties for Voting

- **Pareto Property** – if everybody prefers c_i over c_j, then $\boldsymbol{c_i}$ should be ranked over c_j in the social outcome
- **Condorcet Winner** – if c_i is a condorcet winner, then $\boldsymbol{c_i}$ should *always* be ranked first
- **Independence of Irrelevant Alternatives (IIA)**
  - If c_i ranked over c_j, social outcome should depend only on relative order of c_i and c_j in voter profiles
- **No dictatorships**

Results

- Arrows Theorem
  - For elections with >2 candidates, ***only voting procedure satisfying Pareto and IIA is a dictatorship***
- Gibbard-Satterthwaite Theorem
  - ***Only non-manipulable voting method*** satisfying Paretor property for elections with >2 candidates is a ***dicatorship***

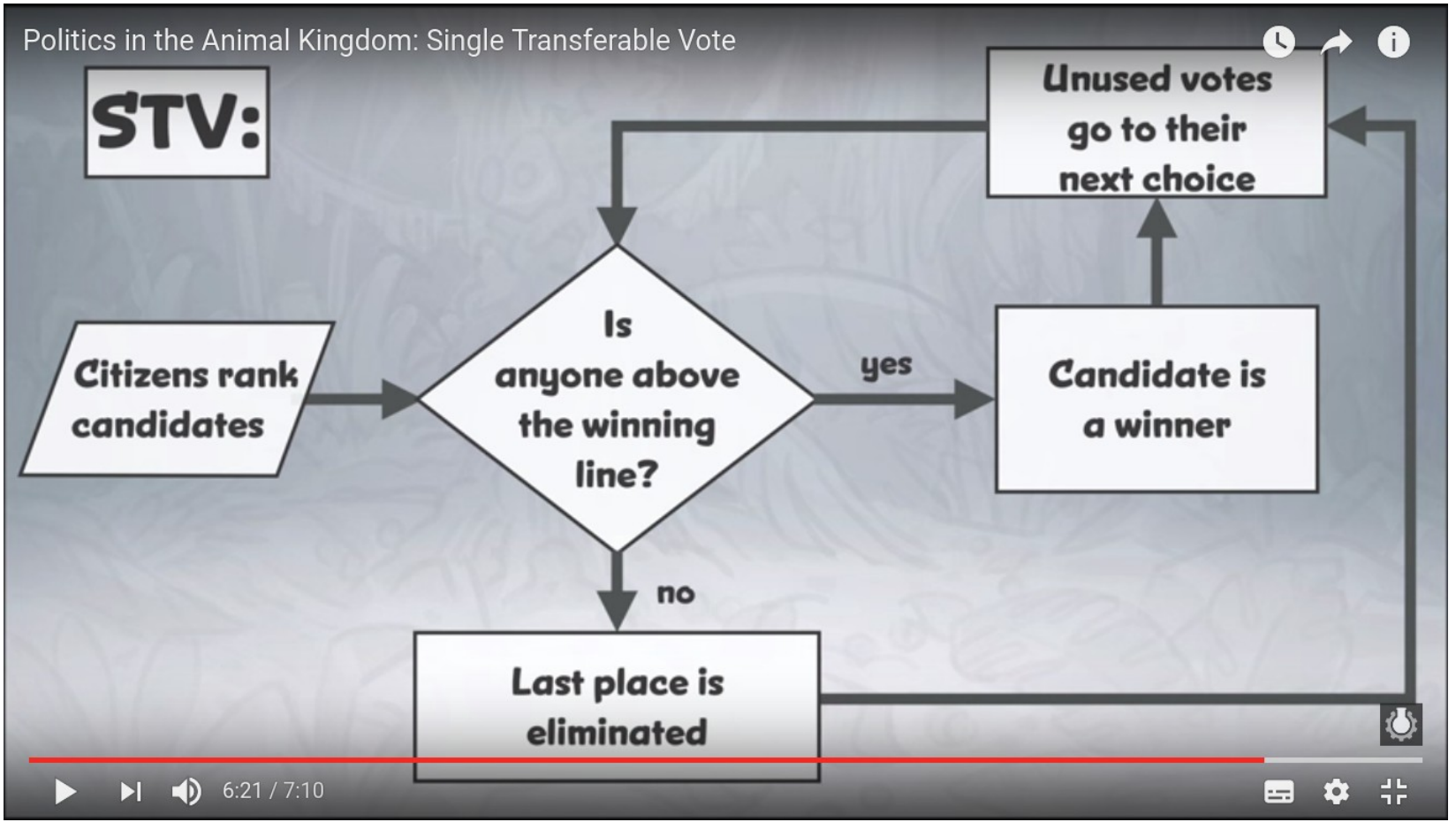
Results

- But … computational complexity helps :-)
  - Elections are prone to manipulation, but manipulation is ***computationally complex***
  - ***E.g. "Single Transferable Vote"*** is **NP-hard to manipulate**

Single Transferable Vote

- Used for selecting a ***group of candidates*** C for a **limited number of seats** S (e.g. parliamentary elections, city counsel elections), where C > S
- If selection of single candidate, the equivalent to *Instant Runoff Voting*

Single Transferable Vote



Single Transferable Vote

- Threshold – Droop quota = $floor\left(\frac{valid\ votes\ cast}{num\ seats+1}\right)+1$
- Surplus votes redistribution
  - $\left(\frac{votes\ for\ next\ preference\ belonging\ to\ original\ candidate}{total\ votes\ for\ the\ original\ candidate}\right)\times surplus\ votes\ for\ original\ candidate$