

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 c_i should be ranked over c_j in the social outcome
- **Condorcet Winner** – if c_i is a condorcet winner, then 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

- Arrow's 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 Pareto property for elections with >2 candidates is a ***dictatorship***

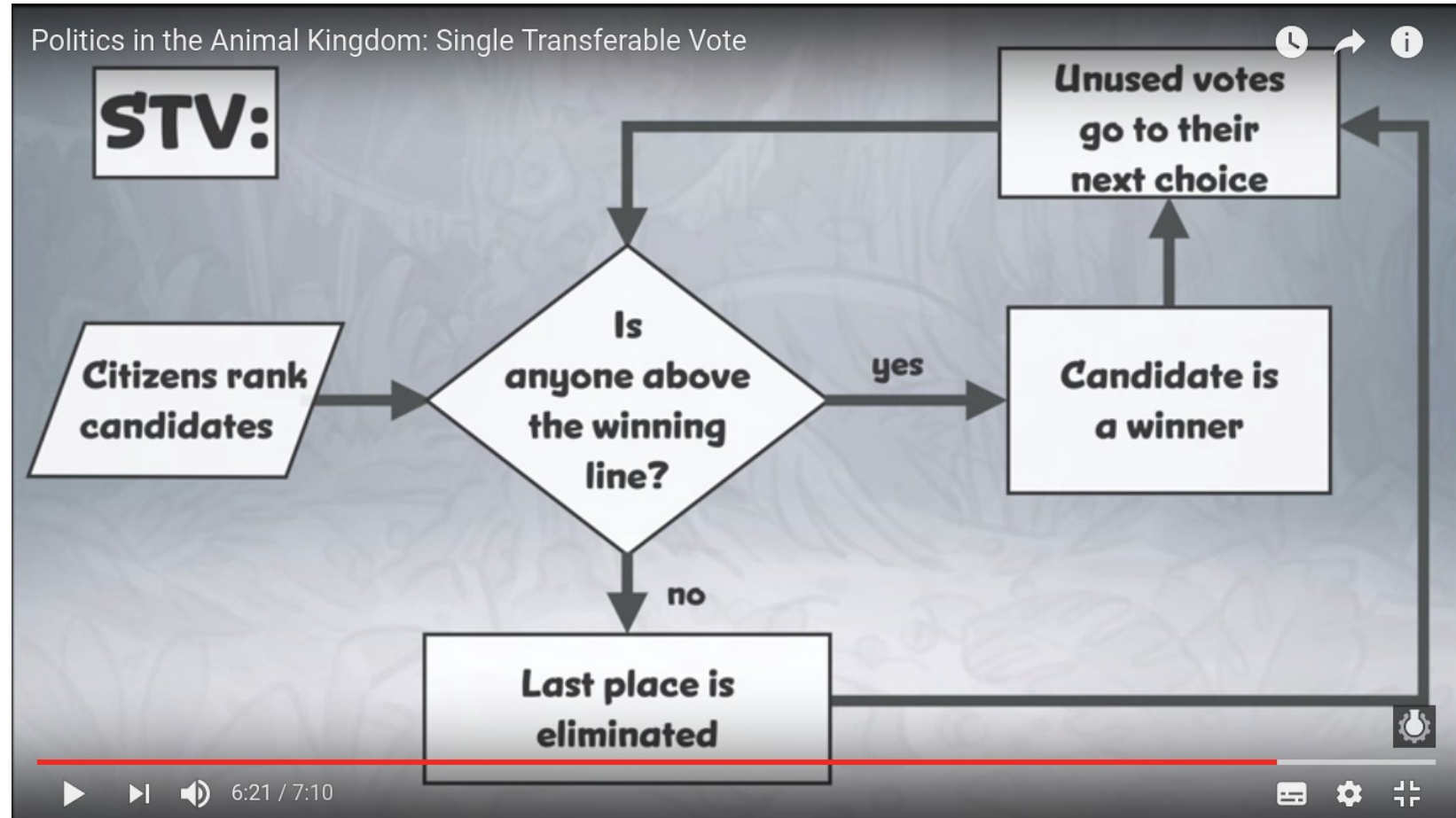
Results

- 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 council elections), where $C > S$
- If selection of single candidate, the equivalent to *Instant Runoff Voting*

Single Transferable Vote



Single Transferable Vote

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