Convicting the Innocent: The Inferiority of Unanimous Jury Verdicts under Strategic Voting

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- **Citizens for a Safer California propose The Public Safety Protection Act (1996)**:replace the unanimous verdict in all but capital murder cases and replace it with a rule requiring only 10-12 jurors to convict.
- **Common Belief:** A unanimous verdict is exactly the mechanism that protects innocent defendants...this protection comes at the cost of an increased probability of acquitting a guilty defendant.
- **'Strategic Voting'** by jurors can undermine this intuition.
- The unanimity rule can lead to a higher probability of both errors.
- Probability of convicting an innocent defendant may actually increase with jury size.
- Other voting rules (simple majority etc.) lead to much lower probabilities of both errors.
- **Condorcet Jury Theorem:** A jury vote aggregates the private information available to the jurors. Private info.

arises due to differing interpretations of the evidence amongst jurors. Hence juries make fewer errors than individual jurors

- **Assumption in prior literature:** people vote as if their individual votes alone determine the outcome

- Private information and common interests provide incentives for strategic voting. A juror's vote matters only if his vote is pivotal and then the private information of other jurors becomes useful.

- Under the Unanimous Rule, a person's vote is pivotal only when everyone else votes to convict. Others voting to convict reveals information about their signals. This information may be overwhelming for the pivotal voter otherwise inclined to acquit.

Modeling Jury Decision Making

- n jurors.
- Defendant either guilty(G) or innocent(I). G and I occur with equal probability.
- **Signals:** Each juror gets a signal g or i s.t.

$$Pr(g|G) = Pr(i|I) = p \tag{1}$$

  where $p \in (.5, 1)$. p is the probability of receiving the correct signal
- Each juror votes to convict(C) or acquit(A).
- **Decision Rules($\hat{k}$):** at least $\hat{k} \leq n$ votes needed to convict(C). Otherwise acquit(A).

  Unanimous Rule: $\hat{k} = n$

  Simple Majority: $\hat{k} = (n+1)/(2)$
- **Strategy**: $\sigma_j : \{g, i\} \to [0, 1]$
- **Utility:** all jurors have identical preferences. $U(A, I) = u(C, G) = 0, u(C, I) = -q$ and $u(A, G) = -1(1-q)$
- $q \in [0, 1]$ is **reasonable doubt**. The higher q is, the more concern jurors have for not convicting innocents. q is identical for all n.
- Observing n signals, k of which are guilty, the **posterior probability of guilt** $\beta(k, n)$ is:

$$\beta(k, n) = \frac{p^k(1-p)^{n-k}}{p^k(1-p)^{n-k} + (1-p)^k p^{n-k}} \tag{2}$$

- if $\beta(k, n) > q$, the defendant is **guilty beyond reasonable doubt**. Optimal outcome: Convict. Otherwise: Acquit

- Assume $\exists \; k^* s.t. \quad n \geq k^* \geq 1$ and

$$\beta(k^* - 1, n) < q < \beta(k^*, n) \tag{3}$$

Nonstrategic Voting: Nothing else matters

- **Voting Informatively**: vote A if signal is i, vote C if signal is g.
- With Informative Voting, the Unanimity Rule ($\hat{k} = n$) leads to a lower probability of convicting innocents ($(1-p)^n$) than any other rule ($\hat{k} < n$)
- With informative voting and the unanimity rule, probability that the convicted person is innocent is:

$$Prob(G|C) = \frac{p^n}{p^n + (1-p)^n} \to 1 \ as \ n \to \infty \tag{4}$$

- Conversely, probability of acquiting a guilty defendant ($1 - p^n$) is strictly higher than any other rule
- This also implies $Prob(Innocent|Convicted) \to 0$ as $n \to \infty$
- Nice properties but Informative Voting is typically not equilibrium behaviour!

Strategic Voting: What if I were pivotal?

Nash Equilibria under The Unanimity Rule ($\hat{k} = n$)

When $k^* = n$

- in this case $\beta(n-1, n) \leq q < \beta(n, n)$
- Informative voting is equilibrium behaviour. We need to show a pivotal voter votes A if signal is i, votes C if signal is g
- **Signal is** i: given that a voter is pivotal, he knows that $n-1$ guilty signals have been received. Hence $\beta(n-1, n) \leq q$ so the defendant is not guilty beyond reasonable doubt so **vote** A.
- **Signal is** g: $q < \beta(n, n)$ so **vote** C.

When $\beta(n-1,n) \geq q$

- A pivotal voter will believe that everyone else must have voted C. So $\beta(n-1,n) \geq q$. Hence even if signal is i he votes C since **the evidence is overwhelming**

- Informative voting can't be a Nash Equilibrium

Lower bound on probability of convicting innocents

Proposition 1

In any Nash Equilibrium where the defendant is convicted with strictly positive probability

$$Prob(Innocent|Convicted) \geq min\{0.5, \frac{1-q}{1+q(\frac{2p-1}{(1-p)^2})}\} \qquad (5)$$

Earlier with informative voting this probability went to 0 as $n \to \infty$

Convicting Innocent Defendants: A Specific Equilibrium

- Consider **symmetric responsive equilibria**
- In a responsive strategy agents vote in accordance with their private information with a positive probability.
- **Proposition 2**: In the identified equilibrium

$$\lim Prob(C, I), \lim Prob(A, G) > 0 \tag{6}$$

- $\lim Pr(G|C) = \frac{1-q}{1+q(\frac{2p-1}{(1-p)})} > \frac{1-q}{1+q(\frac{2p-1}{(1-p)^2})}$

Nonunanimous Rules

- $\hat{k} = \alpha n$ where $0 < \alpha < 1$
- as $n \to \infty$ the probability of making both types of errors converges to 0!!
- **Basic Intuition** A pivotal voter knows that only αn people got the guilty signal. The evidence is less overwhelming!
- Proposition 3