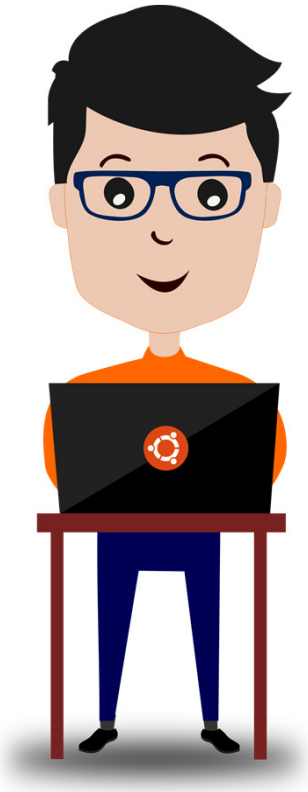
No, More Heads Are Not Better!

J.K. Baltzersen

About Me



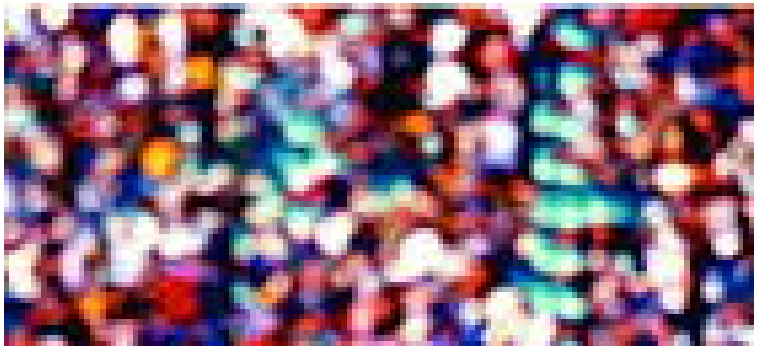
A NEW YORK TIMES BUSINESS BESTSELLER

"An entertaining and thought-provoking as The Tipping Point by Malcolm Gladwell, . . . The Wisdom of Crowds ranges far and wide."
—The Boston Globe

THE WISDOM OF CROWDS

JAMES SUROWIECKI

WITH A NEW AFTERWORD BY THE AUTHOR



Extraordinary Popular Delusions & the Madness of Crowds

"If you read no more of this book than the first hundred pages—on money mania—it will be worth many times its purchase."

From the Foreword by Andrew Tobias

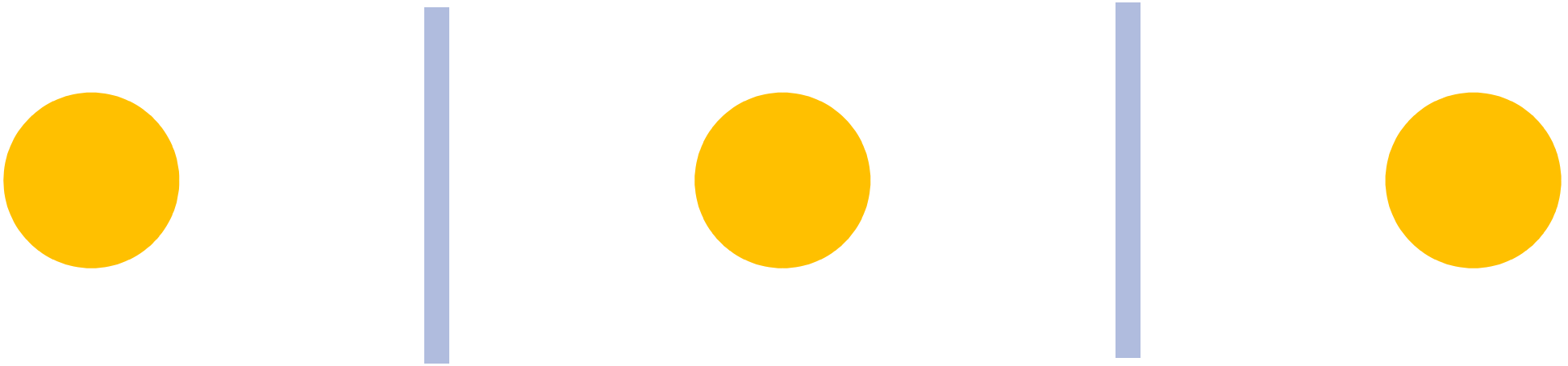
Condorcet's Jury Theorem

- Marquis de Condorcet (1743-1794)
- published 1785

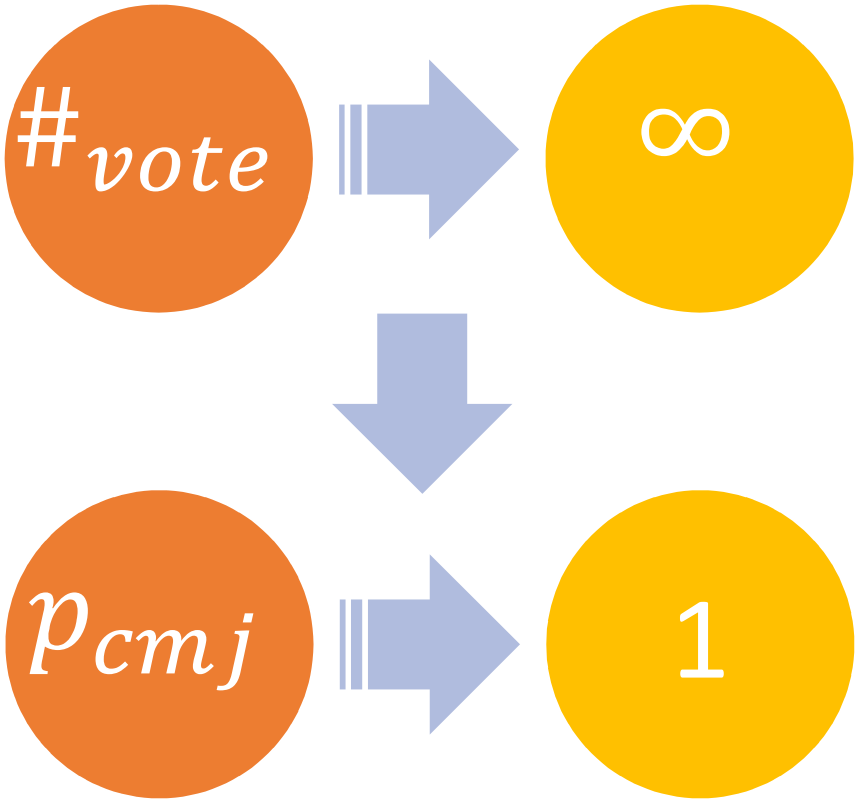
Condorcet’s Jury Theorem

Condorcet's Jury Theorem

Condorcet’s Jury Theorem



Condorcet's Jury Theorem

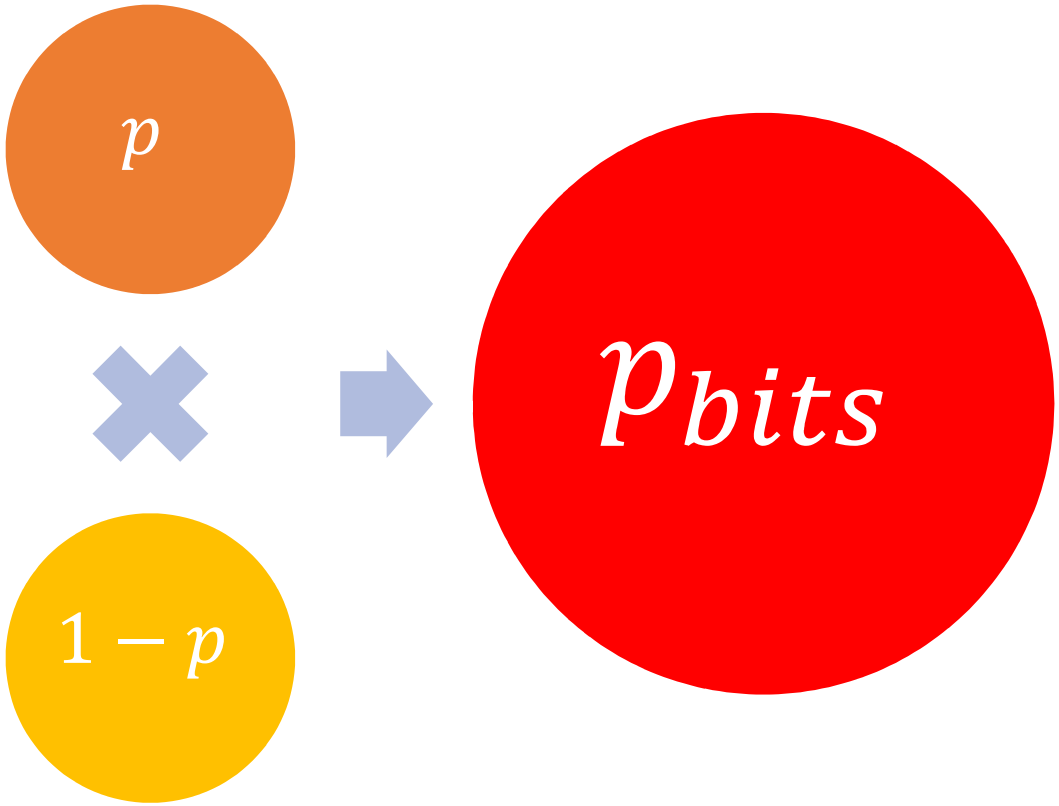


Condorcet’s Jury Theorem

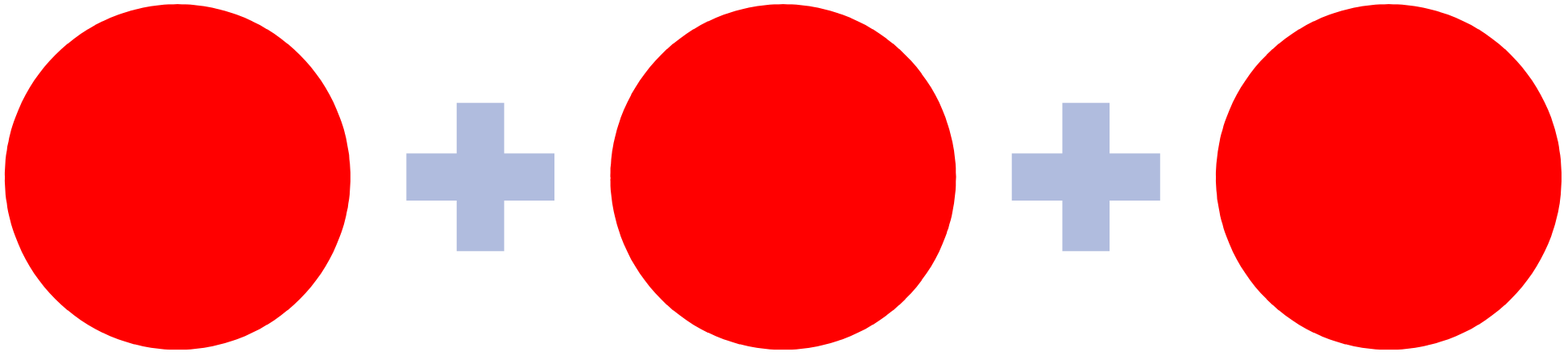
Probability of correct majority decision

Condorcet’s Jury Theorem

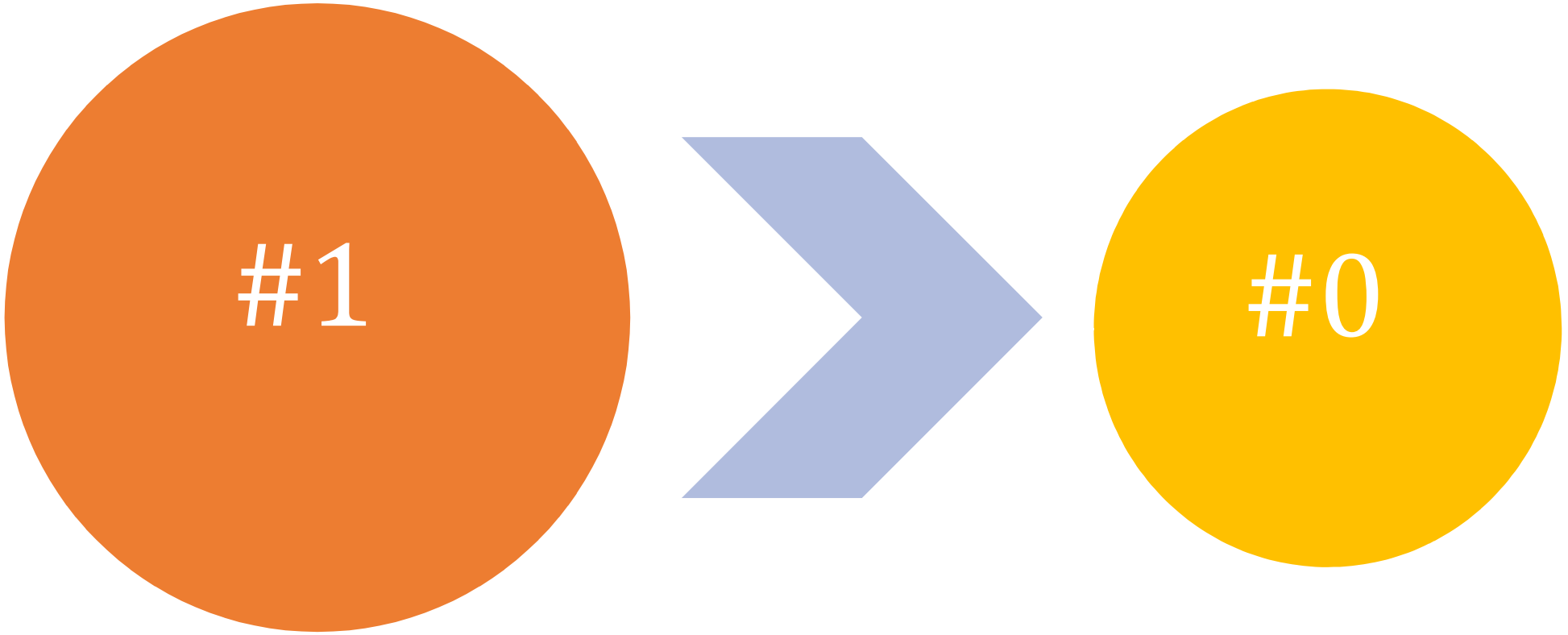
Condorcet's Jury Theorem



Condorcet’s Jury Theorem



Condorcet's Jury Theorem



Calculation Problems

- Overflow
  - standard Windows calculator: 3249!
  - Excel, even worse: 171!
- Long series – calculator insuitable

What to Use

- online hypercalc: https://mrob.com/pub/perl/hypercalc.html
- java.math.BigDecimal + java.math.BigInteger
- GitHub: https://github.com/jornbalt/javazone2018

Run the CJT Calculator

- number of voters: 10,001
- individual probability/competence: 51 %
- probability correct majority decision:

97.72687612793197 %

Individual Incentive?

- Any odd number n of voters: a row of bits
- Number of odd combinations: 2^n
- Number of other voters (even): $2^{n-1} = 2^m$
- random voting model
  - equal probability
  - statistically independent

Individual Incentive?

Penrose Square Root Law

Simplify: Stirling's formula

Probability of tie-breaking for odd number of voters n:

$$\sqrt{\frac{2}{\pi}}\sqrt{\frac{1}{n-1}}$$

Empirical research:

$$C\ \frac{1}{n-1}$$

The Tide Turns

- 10,001 voters give each voter a probability of $\sim 0.8\ \%$ of casting a deciding vote.
- voters disincentivized $\rightarrow$ competence declines
- $51\ \% \ \rightarrow \ 49\ \%$
- Run the CJT calculator: probability of correct majority decision:

2.2731238720680745 %

Independent Voters?

Condorcet’s Jury Theorem falls apart?

Sources

- Condorcet's jury theorem: https://en.wikipedia.org/wiki/Condorcet%27s_jury_theorem
- Stirling's formula: https://en.wikipedia.org/wiki/Stirling%27s_approximation
- Penrose square root law: https://en.wikipedia.org/wiki/Penrose_square_root_law
- Gelman; Katz; Tuerlinckx: *The Mathematics and Statistics of Voting Power*: http://www.stat.columbia.edu/~gelman/research/published/STS027.pdf
- Groupthink: https://en.wikipedia.org/wiki/Groupthink
- James Surowiecki: *The Wisdom of Crowds*
- More: https://github.com/jornbalt/javazone2018

Thank you!

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