(Mis)Representative Power? Mathematicians come up with the Answers.

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"Democracy must be something more than two wolves and a sheep voting on what to have for dinner" -James Bovard

Societies and organizations use various voting schemes for decision making. In the Weighted Voting System such as the UN Security Council and the US 'Electoral College', voters are given 'weights' depending on their 'deserved' influence. Interestingly, mathematicians are being sought to analyse voting powers and devise fairer schemes.

In a voting situation where legislators represent different regions, one could assume it is easy to tell how much power the players exert by merely looking at their weights in a voting game . However things are not that simple. Consider a system where three voters, Green-Party, Lib-Dem and Labour have weights 1, 49 and 50 respectively. If the quota for making a decision is 51 then the winning coalitions are Green-Party, Labour, Lib-Dem, Labour and Green-Party, Lib-Dem, Labour. Although Lib-Dem is representing a much bigger population and has 49 times more voting weight, it seems to have the same power as the Green Party.

In the1940's, British mathematician Lionel Penrose proved that the voting weight of a given state should be proportional to the square root of the state population. His work has been extended recently by Polish scientists from Jagiellonian University and is being eagerly discussed by EU officials.

Simulating real voting scenarios can be even more complicated. Different countries in the UN have influence on each other depending on historical relations, political orientation etc. Dr. Dennis Leech of Warwick University Economics Department says: Although mathematicians are exploring models to represent these inter-dependencies between voters, analysing the voting power of members simply on the basis of the given weight and the quota is interesting and useful. Dr. Leech will be giving a presentation this December to the European Parliament on his work on voting power.

The main idea of power is the ability to change the decision. Two classic power indices are used to quantify the voting power of a 'player': Banzhaf and Shapely-Shubik index. They have background in probability and game theory and depend on the proportion of coalitions in which the player plays a 'pivotal' or 'critical' role to form a winning coalition. There is intriguing research on 'blocking' coalitions, veto powers and other variants of power indices.

What is fascinating is that clever mathematical ideas are not only provid-

ing insight into these problems but providing understanding of fairness and equity.