Ising model

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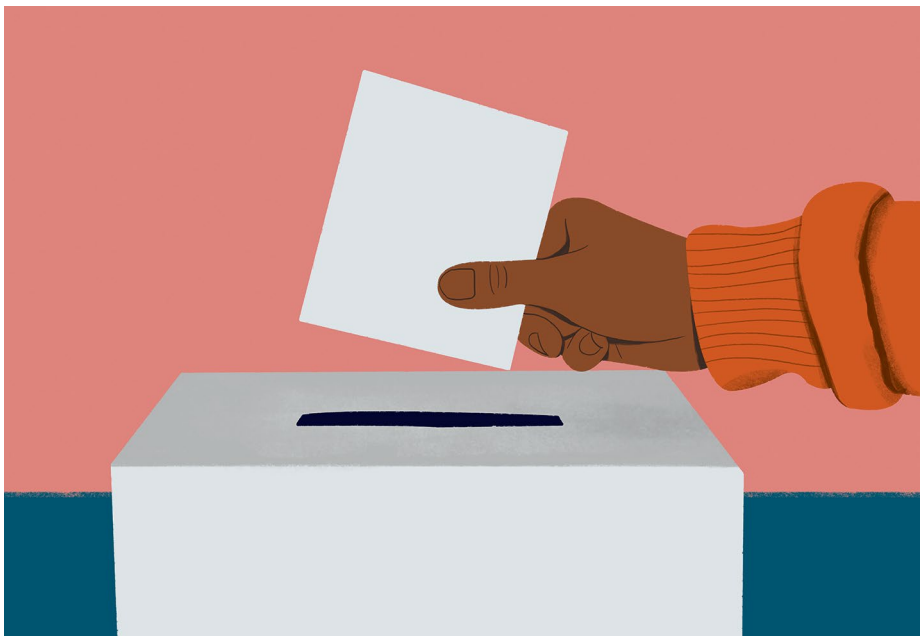
Ising-like model predicts close elections



There's a decent chance you will be affected by an election this year: around half the world's population lives in regions holding polls in 2024. Many elections are remarkably close in terms of vote shares — for instance, in the 2024 Slovak presidential election, the popular vote was split 53% to Peter Pellegrini and 47% to Ivan Korčok. Such close outcomes often happen even if one candidate holds a strong lead in opinion polls in the months before the election. Writing in *Physical Review E*, Olivier Devauchelle and colleagues show that this outcome is a mathematical inevitability — at least in a simplified Ising-like model. They show that if voters tend to agree with their neighbours but dislike aligning with the reported majority opinion, then the electorate can tend towards a 50–50 split, with two spatially segregated camps. This split is a size-dependent phenomenon: the model predicts that smaller electorates tend towards consensus instead.

The model used by Devauchelle et al. is based on an Ising model on a triangular lattice, in which each spin represents the opinion of a voter. (The model assumes there are only 2 candidates to choose between.) The ferromagnetic coupling between neighbouring spins represents the tendency for voters to agree with their neighbours; a second term, which promotes anti-alignment between a spin and the net magnetization of the system, represents a tendency for voters to prefer to vote differently to the majority opinion. The ratio of these two 'energy' terms sets how important the two factors are to voters. The system evolves over time, subject to a finite 'temperature' — in the limit of high temperature, voters choose their opinions randomly at each time step, whereas in the limit of zero temperature they always do what will minimize their energy.

If the voters' behaviour isn't too random, the electorate splits into 2 camps of comparable size, which are spatially segregated. Devauchelle et al. refer to this phenomenon as the split-society phase. From a physics point of view this phase is interesting, because it is ordered, like a ferromagnetic phase is, but its susceptibility (a measure of how much the average vote changes in response to an external influence) doesn't diverge like that of a ferromagnetic phase but stays finite at all temperatures. Studying the susceptibility also indicates that the split-society phase only occurs if the system is large enough.

Zoe Budrikis

Original article: Devauchelle, O., Szymczak, P. & Nowakowski, P. Dislike of general opinion makes for tight elections. *Phys. Rev. E* **109**, 044106 (2024)

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