

# When Representative Democracy Isn't

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The 2016 US election has been antagonistic and remains a source of friction. Some protesters reject Trump as their president due to a wide gulf that exists between them and him. There is a large literature about the failure of voting systems to reflect majority preference [1]. Here we discuss briefly how the nature of representation can break down when people differ. Measures of increasing polarization [2] imply this topic is of importance.

Consider a distribution of opinions of the populace that for simplicity we assume is in one dimension (e.g. left to right). If there is a single peaked distribution, such as a normal distribution, a majority selects the candidate who is closer to the center when everyone votes for the one who is closest to their opinion (Fig. 1A).

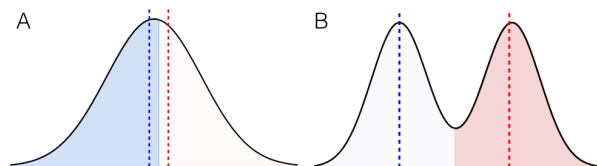


FIG. 1: Distributions of public opinion for which (A) representative democracy can be said to represent the opinion of the public, and (B) only a subgroup of the population is represented. The more darkly shaded region is the majority in an election in which people vote for the candidate (dashed colored lines) closest in opinion to themselves. The two peaked system can have different outcomes due to small shifts in subgroup numbers, gaming of the system, rule bias, other uses of power, motivation, engagement and discouragement, etc. However, any outcome is not representative of subgroups.

If, however, we consider multiple peaks of a distribution, there may not be many present near the center of the public opinion. For two peaks, if individuals near the center of the peaks are voted upon, and one wins, people in the other peak are not going to be represented (Fig. 1B). If one peak is larger, even slightly, it would make the smaller peak never be represented, i.e. the views of this group would not affect adopted policies. If there is a close balance between them then small variations determine which peak “wins.” The variations might include changes in population or nuances in the differences between those running for office. It might also include variations in the rules (simple majority versus electoral system, for example), preventing people from voting, ballot manipulation, and different levels of engagement.

Still, even when there are two peaks, when everyone

votes for the representative closest to them, the majority will favor a candidate closer to the center (Fig. 2A). This is true even when the representative is of an opinion that few in the population share. However, when people don't vote if they disagree sufficiently from both candidates, this is not the case (Fig. 2B,D). The result is different in this case between one and two peaks. In the two peaked case the majority of votes cast may select the candidate farther from the center. A candidate farther from the center wins in a two-peaked distribution if their opinion is in a higher concentration region of voters, as seen in the blue candidate in Fig. 2B. Although the red candidate captures voters in the center, the concentration of voters in the center is not high enough to make up for the voters missed on the far side of the right peak. By contrast, in a one-peaked distribution the greatest concentration lies in the center, the most important segment of the population to capture, and the more central candidate wins (Fig. 2D).

Accordingly, we see that representation need not result from democratic voting in the case of fragmented populations.

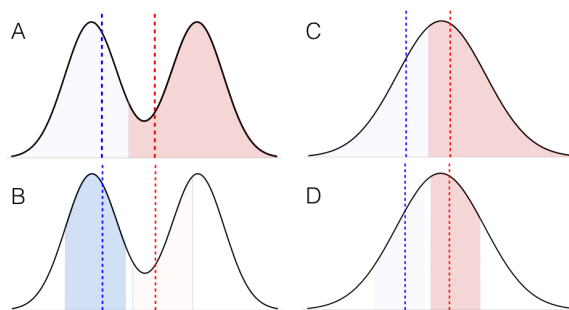


FIG. 2: Similar to Fig. 1 but comparing elections when all voters vote for the closest candidate (top), and when some don't vote because candidates are not close enough to their opinions, or if they are conflicted because they are in-between (bottom). Unshaded area represents those who do not vote for either candidate. A. For a two-peaked distribution when everyone votes the candidate closer to the center wins (the area shaded red is larger than the area shaded blue). B. When some don't vote the candidate farther from the center can win (the area shaded blue is larger than the area shaded red). For the single peaked distribution (right) in both cases the candidate closer to the center gets more votes.

[1] Voting System, Wikipedia (2016) [https://en.wikipedia.org/wiki/Voting\\_system](https://en.wikipedia.org/wiki/Voting_system)

[2] Pew Research (2014) <http://tinyurl.com/m81swml>

[3] M. Lim, R. Metzler, Y. Bar-Yam, Science 317, 5844 (2007) <http://tinyurl.com/2qq2tc>.