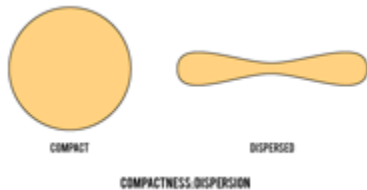


Measuring Compactness: A Fair Redistricting Process

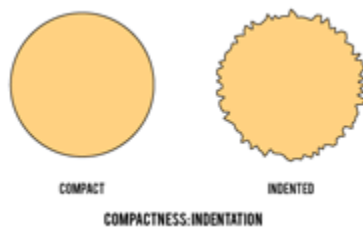
What do you mean by district compactness? How is compactness measured?

A circle is compact. A square is compact. A polygon with donut holes and tentacles extending in many directions is not. Most compactness measures attempt to quantify the geometric shape of a district relative to a perfectly compact shape, often a circle.*

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The compactness measures used in Azavea's redistricting study can be divided into two categories: those that measure the extent to which the shape of a district is spread out from its center (Reock and Convex Hull) and those that measure how smooth or contorted the boundaries of a district are (Polsby-Popper and Schwartzberg).

What are some other compactness measures?

The academic literature describes more than thirty different ways to measure compactness. For our study, we chose four of the most commonly used compactness measures: Reock, Convex Hull, Polsby-Popper and Schwartzberg. Other measures use simple length and width ratios, or sum the perimeters of all the districts included in a plan. More complicated shape-based compactness measures calculate the moment of inertia for a district shape (the variance of distances from all points in the districts to the district's areal center) or evaluate the number of interior angles in a district shape. Population measures--somewhat more difficult to calculate for the entire country--are based on the distribution of the population within a district.

Why is compactness important? Does it really matter?

While Polsby and Popper have lent their names to a particular compactness measure, they argue that the establishment of *any* compactness standard is preferable to none. Others have questioned the utility of such thresholds, and research indicates that the extent to which various compactness measures agree with one another is highly inconsistent. Because each measure of compactness captures a slightly different geometric or geographical phenomenon, it is a somewhat arbitrary choice to select a particular compactness metric as the means of accepting or rejecting a single district boundary.

Probably a better question is, "**Should compactness be a requirement in the redistricting process?**" While geometric compactness measures may appear to be neutral, combined with

geography and real-life patterns of population distribution they may produce reliable political outcomes. One study* concluded that a compactness requirement reduces the representation of racial minorities. Other scholarly work** identifies a variety of biases inherent in automated redistricting and compactness standards, including favoring the majority political party. Clearly, other important components of the redistricting process, such as aggregation of "communities of interest" are not necessarily well served by examining only compactness.

A number of scholars have suggested that compactness measures are best used not as absolute standards against which a single district's shape is judged, but rather as a way to assess the relative merits of various proposed plans. Above all, compactness is most meaningful within the framework of an institutional redistricting process.

* Barabas & Jerit, "Redistricting Principles and Racial Representation," *State and Politics Quarterly*, 4 (4), 2004, pp. 415-435.

** Altman, "Is Automation the Answer? - The Computational Complexity of Automated Redistricting," *Rutgers Computer and Technology Law Journal* 23 (1), pp. 81-142, 1997.

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