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Reapportionment, Gerrymanders, and the Notion of "Compactness"

Joseph E. Schwartzberg*

The frequency of recent reapportionment decisions has increased public concern for voting equality.¹ As legislative districts become more equally populated within a state through legislative and judicial action, attention will likely turn to combating the gerrymander.² Antigerrymandering prohibitions have been on the books, at both federal³ and state⁴ levels, for well over a century; but enforcement has generally been lax or nonexistent.⁵ A bill introduced in the 89th Congress attempting to curtail use of the

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1. See, e.g., Silva, *Apportionment in New York*, 30 *FORDHAM L. REV.* 581 (1962). See also McCloskey, *The Supreme Court, 1961 Term, Foreword: The Reapportionment Case*, 76 *HARV. L. REV.* 54 (1962).

2. The abuse appears to be much older than the term. The device apparently was first used in America in 1705. GRIFFITH, *THE RISE AND DEVELOPMENT OF THE GERRYMANDER* 21, 26-27 (1907). The gerrymander still exists. Despite numerous reapportionment decisions since 1962, the latest map of congressional districts depicts numerous examples. See the map published by the United States Department of Commerce, Bureau of the Census, entitled "Congressional Districts for the 89th Congress" (1962).

3. From 1842 to 1929 "Congress set varying requirements for . . . contiguity and compactness of district territory and equal populations 'as nearly as practicable' . . . But in effect, the antigerrymandering requirements had never been enforced." Congressional Quarterly Weekly Report, Vol. XXIII, No. 12, March 19, 1965, p. 420.

4. E.g., ILL. CONST. art. 4, § 6 provides: "All senatorial districts shall be formed of contiguous and compact territory." Section 7 provides: "Representative districts shall be formed of contiguous and compact territory. . . ."; MO. CONST. art. 3, § 3 provides: "When any county is entitled to more than one representative . . . the body authorized . . . shall divide the county into districts of contiguous territory, as compact and nearly equal in population as may be. . . ." Section 5 provides: "For the election of Senators, the state shall be divided into convenient districts of contiguous territory, as compact, and nearly equal in population as may be."

5. BROOKS, *POLITICAL PARTIES AND ELECTORAL PROBLEMS* 476 (1923).

gerrymander requires, among other things, that congressional districts be composed of contiguous territory in compact form.⁶ Such a districting requires objective standards based in part on a meaningful definition of "compactness." Present and proposed legislative definitions of compactness are generally nothing more than definitions of fairness.⁷ This comment presents a simple, objective, and workable definition of compactness and a reasonable standard for its application. This definition and this proposed standard are suitable for guiding legislatures in the districting process or for assisting courts in adjudicating disputes arising from alleged abuses under existing districting statutes. If used they would greatly reduce gerrymanders and place the burden of justifying a noncompact district on the legislature.

For any given two dimensional area the most compact shape is a circle. No other geometric figure has as low a ratio between its perimeter and area. The relative compactness of any other figure may be determined by finding the ratio of its perimeter to the perimeter of a circle of equal area. The ratio serves as an index of compactness. The index number of a circle is taken to be one. All other indices are higher and represent varying degrees of departure from perfect compactness. Thus, the index number of a perfect square is 1.13, of an equilateral triangle 1.29, and of a perfect five point star 1.95.⁸

While determining the index of compactness for simple geometric figures is easy, the complex, irregular figures formed by actual electoral districts normally present greater problems. Cur-

6. H.R. 5505, 89th Cong., 1st Sess. (1965). This was one of four main sections of the bill. The others provided for a maximum population deviation of 15% from the mean population of all the districts in the state; prohibited at large elections in all states having more than one representative; and forbade redistricting more than once each decade. See *Congressional Quarterly Weekly Report*, Vol. XXIII, No. 11, March 12, 1965, p. 404.

7. The House Judiciary Committee Report on the Celler Bill found compactness to be the absence of any attempt:

1. To divide (a territorial unit) into election districts in an unnatural and unfair way with the purpose of giving one political party an electoral majority in a large number of districts while concentrating the voting strength of the opposition in as few districts as possible.
2. To divide (an area) into political units in an unnatural and unfair way with the purpose of giving special advantages to one group.

H.R. REP. No. 140, 89th Cong., 1st Sess. 2 (1965).

8. Thus, for example, a square with sides of 6 inches would have a perimeter of 24 inches and an area of 36 square inches. A circle of the same area (36 square inches) would have a circumference of 21.28 inches. The ratio of the 24 inch perimeter of the square to the 21.28 inch perimeter of the circle of equal area is 1.13.

vatures or extensions created by natural boundaries such as meandering streams may make it exceedingly difficult to determine the compactness of a district. For example, a basically square district, appearing on a small scale map to have twenty-five mile sides, might on one side have a tortuous riverine boundary well over one hundred miles long. Thus, its measurable perimeter would be closer to two hundred than to one hundred miles, and its index of compactness would be almost doubled. In order to avoid such spurious findings, it is necessary in practice to focus upon the gross dimension of shape, not on the minute irregularities.

There are a number of ways to determine the gross perimeter of an electoral district and thus determine its index of compactness. The method put forward here involves first determining the constituent units forming the district. They may be city blocks, wards, townships, counties, or areas arbitrarily bounded by highways, natural boundaries, and so forth. Next the "trijunctions"⁹ of those constituent units lying along the perimeter of the district are marked on a map of suitable scale for accurate measurement of the intervening distances.¹⁰ The distances along straight lines connecting adjacent trijunctions are then measured. Their total length constitutes the gross perimeter of the district.

Examination of the congressional districts of North Carolina as apportioned for the 89th Congress illustrates the proposed method.¹¹ Figure 1 (see Appendix) shows the state with its congressional districts and constituent counties. Figure 2 illustrates the 382 mile gross perimeter of the First Congressional District of North Carolina. When this perimeter is compared with the circumference of a circle of the same area as the true area of the district,¹² the ratio of the perimeters of the two figures is 1.14.

9. A "trijunction" is defined as a point at which any three given areas meet. A perimeter trijunction is normally the point at which two constituent units of a district meet an adjoining district, or another state, or territorial water, or a foreign county. But a trijunction exists also where one county meets territorial water and a state, or two states.

10. The smaller the districts the larger the requisite map scale. For most congressional districts, except in urban or suburban areas, a scale of 1:1,000,000 (roughly 16 miles to the inch) will suffice. For districts formed in urban areas a scale of 1:25,000 (roughly two-fifths of a mile to the inch) may be required.

11. North Carolina is a good example because it has a fairly large number of attenuated districts; furthermore, being a coastal state, it affords an opportunity to demonstrate the mechanics of the system in such a situation.

12. The area within the gross perimeter, the gross area, will deviate somewhat from the actual area of the district. Since the gross area in most instances will closely approximate the true area, which is already available, it seems

This index number as shown in Table A is smaller than the index of compactness of any other district in the state.¹³ Figure 3 shows the gross perimeter of all eleven districts.¹⁴

TABLE A
Area, Gross Perimeter, Index of Compactness, Population and Deviation
from Mean Population of Congressional Districts of North Carolina
as Apportioned for the Eighty-Ninth Congress

No. of District	Total Area (Sq. Mi.)*	Gross Perimeter (Mi.)	Index of Compactness	1960 Population (1,000's)	% Deviation from Mean Population
1	8,909	382	1.14	278	-32.9
2	3,991	429	1.92	350	-15.5
3	7,561	519	1.68	430	+ 3.9
4	4,265	431	1.86	461	+11.4
5	4,134	453	1.97	454	+ 9.7
6	1,782	190	1.27	487	+17.6
7	5,231	330	1.29	449	+ 8.5
8	4,006	446	1.99	491	+18.6
9	4,174	439	1.91	404	- 2.4
10	2,769	380	2.04	390	- 5.8
11	5,890	393	1.46	361	-12.8
Total	52,712			4,556	
Average	4,792		1.68	414	12.7**

*Land plus inland water

**+ or - sign ignored in computing this average

Having a means of measuring compactness, we can turn to the problem of determining a maximum acceptable deviation from perfect compactness. Of course, any maximum figure chosen will be arbitrary, just as the often proposed figure of fifteen per cent maximum deviation from average population for congressional districts¹⁵ is arbitrary. Inspection of the map of congressional districts for the 89th Congress in general, and of the districts of North Carolina in particular, plus experimentation with various index numbers (1.5, 1.75, and 2.0) leads me to suggest that indices of compactness up to 1.67 should be considered reasonable. Dis-

reasonable when determining compactness to use the gross perimeter with the true area. But, should it be desired, the gross area could be computed trigonometrically.

13. Table A also shows the populations of the several districts and their departure from the state average. It is evident that the oddly-shaped districts were not generally created to achieve equal populations.

14. A larger map at a scale of 23.6 miles to the inch was used for the measurements in Table A. For official purposes a still larger scale would be recommended.

15. See, e.g., H.R. 5505, 89th Cong., 1st Sess. (1965).

districts with higher indices would then be classified as "noncompact" and unsatisfactory.¹⁶ A state may, however, choose a different maximum index of compactness.

Figure 4 presents a possible redistricting of North Carolina in such a way as to obtain districts having (1) deviations of not over 15 per cent from the average district population and (2) indices of compactness not over 1.67. This redistricting manages, additionally, to retain the largest town presently in each district. To achieve the result depicted it was necessary to reassign only twelve of the state's one hundred counties. Probably no smaller shift of territory could have achieved these results. Table B shows the index of compactness and the deviation from mean population for the districts of Figure 4. The average index is reduced from 1.68 to 1.45 and the average population deviation from 12.7 per cent to 8.3 per cent.¹⁷ Presumably comparable results could be obtained by any state legislature where the need for redistricting arises.

TABLE B

Area, Gross Perimeter, Index of Compactness, Population and Deviation from Mean Population of Congressional Districts of North Carolina as Per Suggested Reapportionment with Minimal Boundary Shifts

No. of District	Total Area (Sq. Mi.)*	Gross Perimeter (Mi.)	Index of Compactness	1960 Population (1,000's)	% Deviation from Mean Population
1	10,587	432	1.18	377	- 8.7
2	5,085	373	1.48	444	+ 7.2
3	6,678	406	1.40	394	- 5.1
4	3,472	340	1.63	476	+15.0
5	2,827	312	1.66	356	- 9.2
6	1,483	177	1.30	375	- 9.4
7	5,231	330	1.29	449	+ 8.5
8	3,842	347	1.58	476	+15.0
9	4,540	340	1.44	363	- 1.4
10	2,857	295	1.56	405	- 2.2
11	6,110	389	1.40	375	- 9.4
Total	52,712			4,556	
Average	4,792		1.45	414	8.3**

*Land plus inland water

**+ or - sign ignored in computing this average

Creating a maximum index of compactness transfers the burden of proof in a dispute over the legality of district bound-

16. The North Carolina districts so classified, 2, 3, 4, 5, 8, 9, and 10, are shaded in a dark tone in Figure 3.

17. See Table A.

aries from the attacking party to the apportioning legislature. Attenuated districts would be acceptable if the legislature demonstrated reliance on factors sufficient to override the general policy of compactness or in cases in which the shape of the state might make the creation of compact districts difficult, if not impossible. For the latter possibility, Cape Cod and Long Island provide cases in point.¹⁸ But, as most states are quite compact, such cases should be rare. Of the 435 existing congressional districts the compactness of only a dozen or so appear to me to be affected to a significant degree by the shape of the state. Significantly, in North Carolina the Eleventh District is the one most adversely affected by the shape of the state; yet it is one of the four districts classified as compact.

It is not imagined that the proposed law or any other law providing for the creation of compact electoral districts of equal population will automatically bring an end to gerrymandering. However, effective laws could greatly restrict the latitude for manipulation of district boundaries toward such an end and reduce the number and magnitude of abuses.

18. A state legislature cannot control the shape of Cape Cod or Long Island. Therefore in such cases there is no impropriety when natural boundaries dictate noncompact electoral districts. Similar problems may arise where statutes stipulate that electoral districts shall be comprised of already existing single constituent units. If one of these units is elongated (Apache County, Arizona, is such a possible unit), the legislature should not be censured for allowing such a noncompact district to remain.

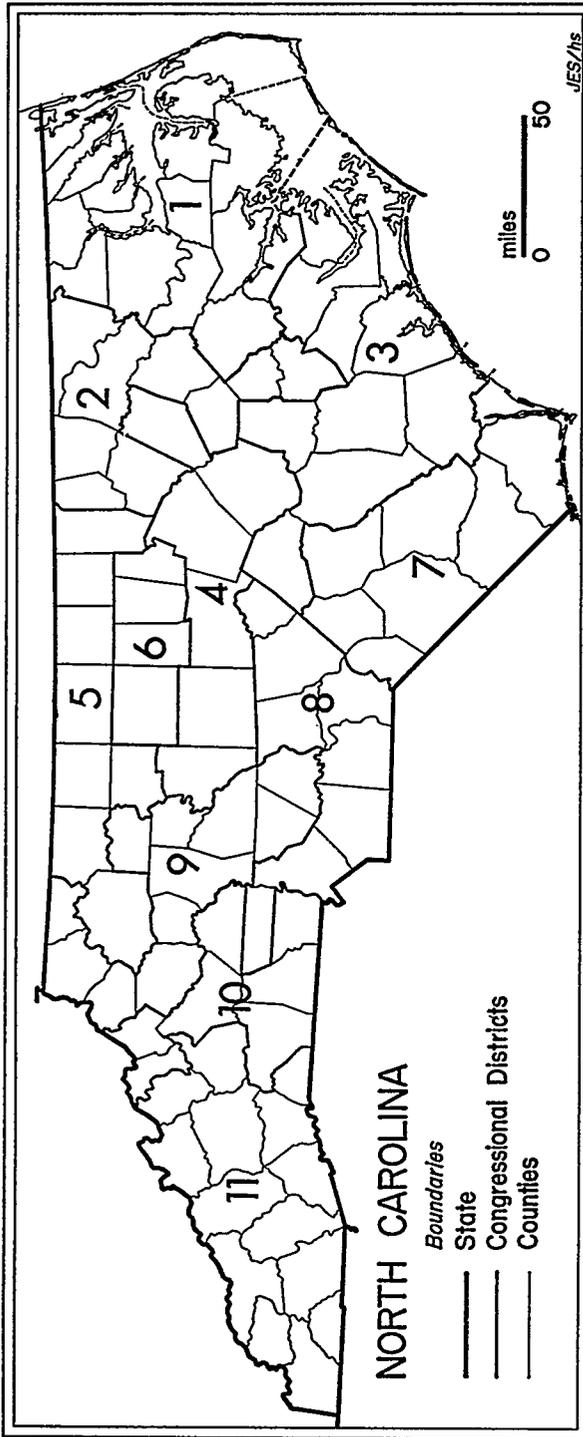


Fig. 1

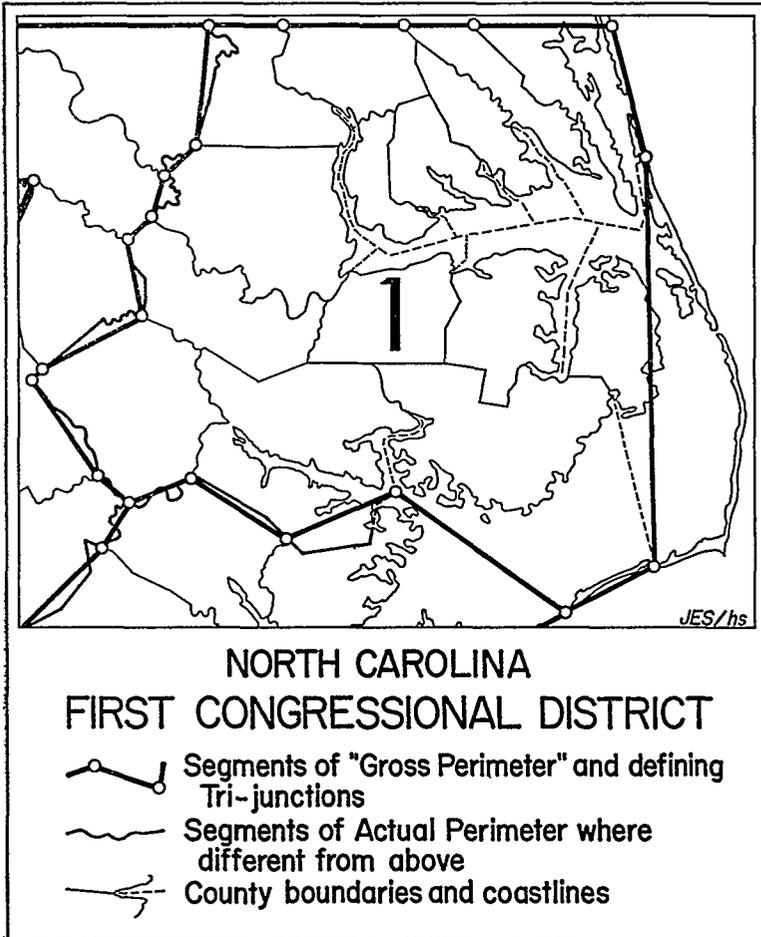


Fig. 2

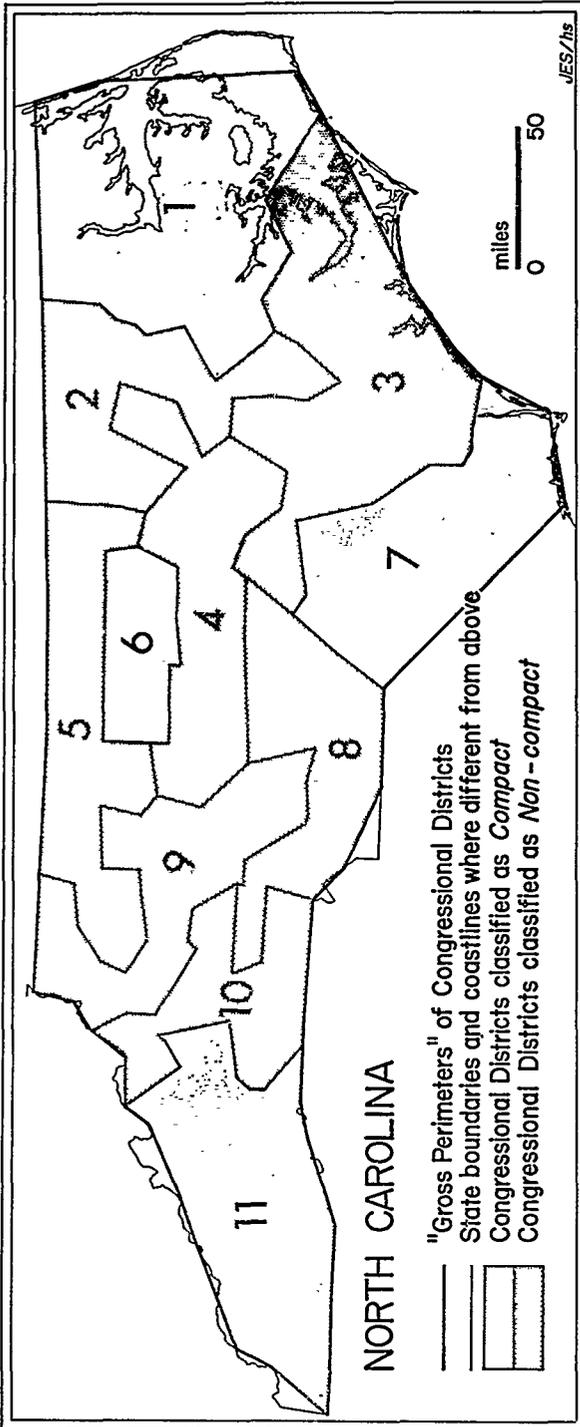


Fig. 3

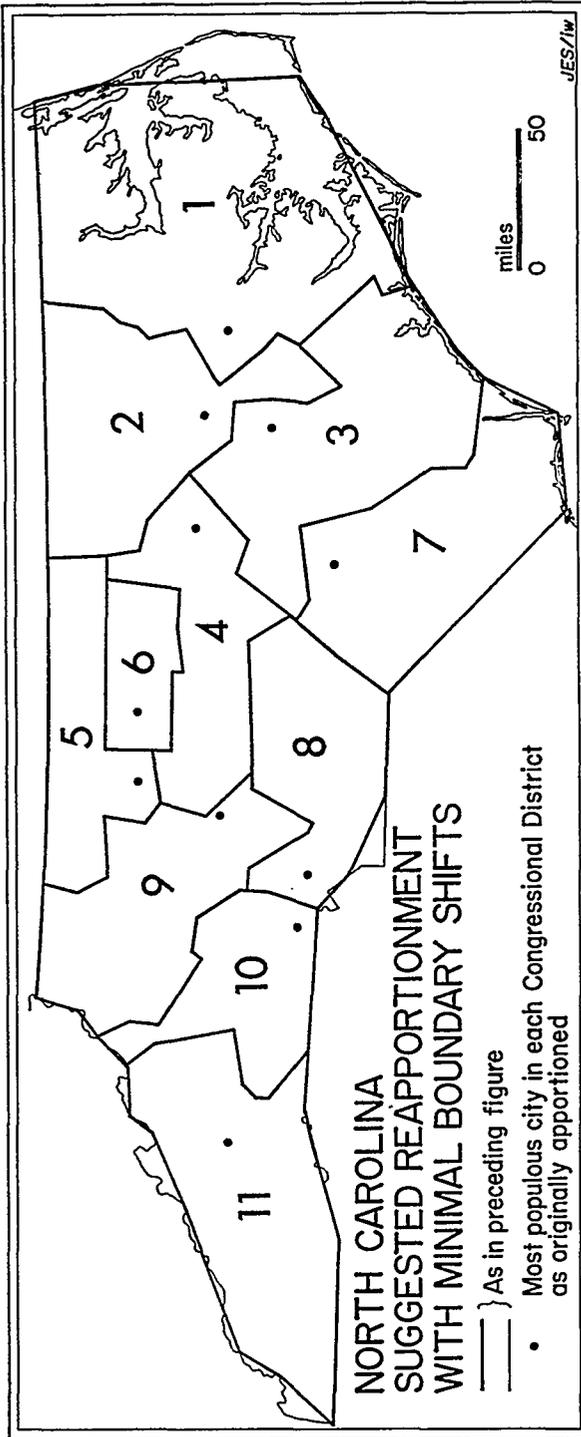


Fig. 4