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MEASURING AND COMPARING TWO-DIMENSIONAL SHAPES

1. INTRODUCTION

Much time and energy has been expended on the study of shape, a fundamental property of geographic phenomena. Interest has been especially strong in the fields of cartography, geomorphology, economic geography and political geography. While the reasons for the interest in the first two fields are self-evident, an explanation for the interest in the latter fields is appropriate.

Many of the models of twentieth century location theory and geography are derived in part from studies of central places and regional space packing. In combination, these have evolved into the notion of a hexagonal lattice of service areas for various human activities such as marketing and transportation, if the assumptions of the models are met. By definition, the actual shapes of the service areas are, in large part, a function of the nature of the surface on which the lattice of service areas develops. Therefore, most theoretical studies have concentrated on the mechanisms of service area generation on a real-world surface and then inferred the existence of a hexagonal lattice through such techniques as Thiessen polygons (Dirichlet regions) generated by a simulation of the same mechanisms on an isotropic surface.

It is clear that the shapes of service areas on a real-world surface cannot be expected to be regular hexagons. It is also clear, however, that if the principles underlying the notion of a hexagonal lattice are correct, certain aspects of that lattice should be present. The two most important aspects are compactness and contiguity. The first aspect — "compactness" is a "measure of nearness between surface elements of [a] figure" (Frolov, 1975, p. 677). This aspect derives from the concepts of threshold and range and the assumed efficient use of space. This last point is perhaps the single most important premise of economic location theory. In a sense these hexagons represent a compromise between circular service areas "overproviding" for the client population (intersecting ranges for a particular service) and similar service areas "underproviding" for the client population (tangent ranges), the key being the shape efficiency of the circle. In the game of chess, two equally matched opponents will most often play to a stalemate. In the game of location theory, suppliers and consumers (if equally matched) should also play to a stalemate,
a compromise of efficiency or compactness that is represented on an isotropic surface by a lattice of hexagons. Similarly, the second aspect — contiguity — derives from the first. In a hexagonal lattice of service areas, excluding boundary cases, each service area is contiguous with six other areas.

Shape is also the basic component of the morphological approach in political geography, an approach that may be defined as the study of the pattern, shape and structure of political areas. The morphological approach is an intuitively obvious way for geographers and planners to study the effects of physical, albeit often quite permeable, barriers on political areas. The approach is also one of the ways in which geographers and planners may examine the implications of physical shape for the internal organization of and the efficiency of service delivery within political areas (aspects of the classic form-process question).

The notion of efficiency in the use of space is a most important premise of political location theory as well. While the economic geographer might define this efficiency in terms of movement cost or time (for example, delivery costs for goods and services), the political geographer might be more interested, at the national level, in the speed with which troops may be dispatched to an international border or the difficulty of patrolling an irregular versus a regular (in the extreme case, circular) border. At the local level, the shape of an administrative area will to varying degrees influence, among other things, the efficiency of medical, educational, and social welfare service deliveries and the cost of building and maintaining a local transportation system.

It may also be argued that the shape of a political area influences to some extent the degree of political and social integration of the population. Although counter-examples may be cited, we see that in many cases compactness and, failing that, physical contiguity are directly related, along with size, to political and social cohesion. Other factors are certainly of great significance in this regard, yet a fragmented (or divided) state is quite obviously at a disadvantage.

Traditionally, political geographers attempted to address this topic using a small set of categories to classify the shapes of compact (Uruguay), elongated (Chile), prorupted (Afghanistan), fragmented (Malaysia), and enclave-perforated (West Berlin) areas, as well as areas shaped like boots, mittens, pork chops, snails, hooks, diamonds, and tear drops. Farther along the spectrum of description, Tyler and Wells (1971, p. 2) reported that one 1961 New York congressional district was called by critics "The Camel Biting the Tail of the Buffalo Which is Stepping on the Tail of the Dachshund."