Chapter 3
Cultural Dasymetric Population Mapping with Historical GIS:
A Case Study from the Southern Appalachians

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ABSTRACT

There has been a recent flurry of interest in dasymetric population mapping. However, the ancillary coverages that underlie current dasymetric methods are unconnected to cultural context. The resulting regions may indicate density patterns, but not necessarily the boundaries known to inhabitants. Dasymetric population mapping is capable of capturing the cultural commonality and community interaction that define social spaces. Dasymetric mapping may be improved with methodologies that reflect the ways in which social spaces are established. This research applies a historical GIS methodology for identifying early 20th Century agricultural neighborhoods in southern Appalachia. The case study is intended to encourage discovery of additional methods for mapping population on the scale of lived experience.

INTRODUCTION

Human geographers' use of dasymetric mapping has increased with advances in geospatial data. By intersecting land use imagery or property parcel data with census geography, gradations in population density are revealed that refine the cartographic basis for investigating the cultural landscape. The resulting dasymetric spaces ground spatial analysis of social issues like environmental justice. Most dasymetric analysis, however, is predicated on the problematic assumption that discontinuities in population density align with the boundaries delimiting the micro-regional cultural landscape of neighborhoods and communities. Cultural dasymetric mapping, cartography that conforms dasymetric space to cultural contours, is a rarity. The following review of the dasymetric literature chronicles this inconsistency, calling

attention to the need for culturally informed dasymetric mapping. The methodology presented in the case study section offers an example of cultural dasymetric mapping and invites exploration of the diversity of techniques for infusing dasymetric mapping with cultural significance.

DASYMETRIC MAPPING

Dasymetric mapping is designed to improve upon choropleth maps that employ arbitrarily bounded enumeration areas. Choropleth mapping is inherently problematic in two fundamental ways. First, choropleth maps suffer from the modifiable areal unit problem (MAUP) (Langford & Unwin, 1994; Openshaw, 1984): "Any observed pattern in the mapped data may be to a large extent due to the particular configuration of zonal boundaries used, and all relationships observed between variables will only hold for this particular aggregation" (Martin, 1996, p. 974).

Second, areal boundaries drawn without reference to the choropleth map subject invite the "ecological fallacy," that is, areal units imply regional homogeneity and mask internal heterogeneity. Regional homogeneity is defined by the human geography textbook trichotomy of functional, formal, and perceptual regions. Functional regions are determined by spatially conscribed interaction. Fellow residents of functional regions - school districts, for example – are compelled to cooperate. Formal and perceptual regions are based on identity. In the case of formal regions, inhabitants may be objectively ascribed a shared identity through common socioeconomic or cultural characteristics. Perceptual regions are self-designated. Residents share an attachment to place and regionally define their community.

As the basis for much spatial analysis, census geography offers an important example of these two ills of choropleth mapping (Openshaw, 1996; Schuurman, Leszczynski, Fielder, Grund, & Bell, 2006). The foundational US Census unit, the census block, often endorses the ecological fallacy. Outside high density city neighborhoods, census blocks expand to capture sufficient population and their internal heterogeneity increases accordingly (Crandall & Weber, 2005; Goodchild, Anselin, & Deichmann, 1993; Mennis, 2003). The Census Bureau's use of roads to bound census blocks contributes not only to the ecological fallacy but shows how arbitrary boundaries create the MAUP. Rural roads focus residential settlement, community interaction, and identity (Daniels, 1999; Theobald, 2005). Serving as census block boundaries, roads split rural neighborhoods. With rural population concentrated along roadways, rural census blocks are doughnut-like, consisting of peopled peripheries and empty centers. Road boundaries heighten heterogeneity by lumping together fragments of disparate neighborhoods linked by census block circumferences.

Dasymetric mapping promises to resolve the MAUP and the ecological fallacy by incorporating appropriate ancillary information. In keeping with the connotation of "dasymetric" in its original Russian and in Wright's 1936 translational title, "A method of mapping densities of population," the most common method of dasymetric mapping forms boundaries with population density discontinuities. By adjusting thresholds separating density categories, dasymetric boundaries enclose areas of homogenous density (Mennis, 2003).

The application of density based dasymetric mapping to socio-spatial analysis is based on the longstanding assumption that density discontinuities demarcate socially meaningful regions. For example, Goodchild et al. argue that "… the problem of basis change for socioeconomic data can be seen as one of estimating one or more underlying density surfaces" (1993, p. 388), Martin supports "modelling the same information [population characteristics] in the form of density surfaces" (1996, p. 974), and Moon and Farmer assert that "Communities of place could be operationalized by measures of population density …" (2001, p. 46).

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