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Beyond the Census Tract: Patterns and Determinants of Racial Segregation at Multiple Geographic Scales

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SECTION A. CENSUS TRACT BACKGROUND

The census tract has now existed in some form for nearly a century. In 1905, Dr. Walter Laidlaw, executive secretary of the New York Federation of Churches, proposed that New York City be divided into small, permanent geographic areas to facilitate over-time empirical comparisons at the neighborhood level. The Census Bureau adopted his plan on a cost-reimbursable basis, collecting tract data for eight cities in 1910 and 1920 and for 18 cities in 1930 (Bohme 1978; U.S. Census Bureau 1994, 1997; see Laidlaw 1932). Also lobbying on behalf of the tract concept was Howard Whipple Green, a Cleveland statistician appointed in 1931 to chair the newly established Committee on Census

Enumeration Areas of the American Statistical Association. Under Green's leadership, the census tract movement gained momentum, culminating in the publication of standard tract tabulations for all large (250,000+) cities and many smaller ones, beginning with the 1940 census (Bohme 1978; U.S. Census Bureau 1994, 1997). Since then, the Census Bureau has gradually extended tract coverage to the entire nation.

Despite our emphasis on the tract, we do not mean to imply that consensus exists regarding the unit with which to study segregation. Some recent inquiries, for example, employ block groups (Farley and Frey 1994; Frey and Farley 1996), and at least one of the segregation Web sites created after the 2000 census disseminates measures for block groups and blocks as well as tracts (see the Racial Residential Segregation Measurement Project home page at http://enceladus.isr.umich.edu/race/racestart.asp). Our point, developed more fully in the article, is that all analyses using one kind of census unit are spatially problematic. We stress tract-oriented work because its frequent appearance in the published literature renders it especially visible.

SECTION B. RECENT SEGREGATION RESEARCH

The groundwork for current segregation research was laid over a two-decade span beginning in the 1960s, when several major descriptive studies were launched (Lieberson 1963, 1980; Sorensen, Taeuber, and Hollingsworth 1975; Taeuber and Taeuber 1969; Van Valey, Roof, and Wilcox 1977). These studies, which underscored the extent to which African Americans and Whites occupied separate urban neighborhoods, established a key methodological precedent: measuring segregation with decennial census data for readily available geographic units such as tracts or blocks.

Largely adhering to precedent, more recent investigations of data from the 1980 to 2000 period confirm many past results—in particular the high level of Black–White segregation—but they also document the residential circumstances of metropolitan Hispanics and Asians (Farrell 2005, 2008; Fischer 2008; Glaeser and Vigdor 2003; Iceland, Weinberg, and Steinmetz 2002; Logan, Stults, and Farley 2004; Massey and Denton 1993; for a review, see Charles 2003). The index of dissimilarity (*D*), which reflects the evenness dimension of segregation, figures prominently in these investigations, as does the "isolation" version of *P** (denoting the degree of own-group exposure). The norm is for non-Hispanic Whites to serve as the reference population against which the residential distributions of Hispanics, non-Hispanic Blacks, and non-Hispanic Asians are evaluated.

The number of metropolitan areas across which *D* and *P** are calculated differs by study. Some researchers limit their attention to areas that rank among the 50 or 100 largest in total population (Charles 2003; Farrell 2005, 2008). For others, the population size of the minority group of interest serves as the decisive criterion for including or excluding a metro area from consideration (Logan et al. 2004; Timberlake and Iceland 2007). Only Iceland and colleagues (2002) analyze racial segregation in all metro areas (N = 330), although they also present segregation estimates for subsets of areas that satisfy minority size standards.

As noted in the article, African Americans remain the most segregated group from Whites as of 2000. The distinctiveness of Blacks' residential situation is highlighted by the substantial percentage of metropolitan areas with high levels of Black–White segregation (*D*'s of 60+) and the large share of all Blacks (nearly 70 percent) who live in such areas. A mean Black–White *D* value in the mid-60s indicates that nearly two-thirds of

African American metro residents would have to change neighborhoods (tracts) to be distributed in a proportionally even fashion with Whites. For Hispanics and Asians, the corresponding means fall in the low 50s and low 40s, respectively. Smaller gaps are apparent with respect to isolation (*P**). Like African Americans, Hispanics now reside in tracts where, on average, a majority of their neighbors belong to the same minority group that they do. For Asians, over three in ten neighbors are co-ethnics (Charles 2003; Iceland et al. 2002; Logan et al. 2004)

The picture painted here obscures considerable variation by metropolitan context. Iceland and colleagues (2002), for example, identify several metropolitan areas—Detroit, Milwaukee, New York, Newark, and Chicago—with Black–White *D* scores of 80 or more. Yet San Jose, Orange County, CA, and other areas fall near or below the 40 mark. A similar range of Hispanic–White *D* values (from the 20s through the 60s) exists across metro areas; less dispersion is evident in Asian–White levels of segregation. The observed variation in segregation does not appear to be random. Black and Hispanic segregation levels vary by region, with higher means for Northeastern and Midwestern metropolises than for their Western and Southern counterparts. Metropolitan population size is another consistent correlate: larger metro areas tend to be more segregated than smaller ones, irrespective of the racial groups for which *D* or other measures are computed.

To a greater degree than prior research, recent work seeks to explain as well as to describe levels of racial residential segregation. Much of this research follows the structural framework developed by Farley and Frey (1994); hypotheses from the framework are presented in our article. Substantial attention has also been devoted to group-specific residential preferences and discriminatory behavior in the real estate market as causes of racial segregation (Briggs 2005; Charles 2005; Emerson, Yancey, and Chai 2001; Goering 2007; Krysan and Farley 2002; Ross and Turner 2005; Yinger 1995). Unfortunately, preference and discrimination data exist for a relative handful of metropolitan contexts, so the ability of these factors to account for intermetropolitan variation in segregation is difficult to gauge.

SECTION C. ADDRESSING THE CHECKERBOARD PROBLEM

In response to the checkerboard problem and similar shortcomings, Massey and Denton (1988) evaluate a number of measures of what they term the clustering, centralization, and concentration dimensions of segregation. These measures are designed to incorporate locational detail and thus compensate for the aspatial character of the most common evenness (*D*) and exposure (*P**) indices. However, due to the computational effort required and their high intercorrelations, the clustering, centralization, and concentration measures do not enjoy widespread usage (for an exception, see Iceland et al. 2002). Reardon and O'Sullivan (2004) point out conceptual deficiencies as well, arguing that Massey and Denton's dimensions—in the absence of spatial aggregation—can be reduced to cross-cutting evenness/clustering and exposure/isolation continua.

SECTION D. SAMPLE METROPOLITAN AREAS

Akron, OH; Albany–Schenectady–Troy, NY; Albuquerque, NM; Allentown–Bethlehem–Easton, PA–NJ; Atlanta–Sandy Springs–Marietta, GA; Austin–Round Rock, TX; Bakersfield, CA; Baltimore–Towson, MD; Baton Rouge, LA; Bethesda–Gaithersburg–Frederick, MD; Birmingham–Hoover, AL; Boston–Quincy, MA; Bridgeport–Stamford–Norwalk, CT; Buffalo–Niagara Falls, NY; Cambridge – Newton – Framingham, MA; Camden, NJ; Charlotte – Gastonia – Concord, NC – SC; Chicago – Naperville – Joliet, IL;

Cincinnati – Middletown, OH – KY – IN; Cleveland – Elyria – Mentor, OH; Columbia, SC; Columbus, OH; Dallas – Plano – Irving, TX; Dayton, OH; Denver – Aurora, CO

Detroit–Livonia–Dearborn, MI; Edison, NJ; El Paso, TX; Essex County, MA; Fort Lauderdale – Pompano Beach – Deerfield Beach, FL; Fort Worth–Arlington, TX; Fresno, CA; Gary, IN; Grand Rapids–Wyoming, MI; Greensboro–High Point, NC; Hartford–West Hartford–East Hartford, CT; Honolulu, HI; Houston–Sugar Land–Baytown, TX; Indianapolis, IN; Jacksonville, FL; Kansas City, MO–KS; Knoxville, TN; Lake County–Kenosha County, IL–WI; Las Vegas–Paradise, NV; Little Rock–North Little Rock, AR; Los Angeles–Long Beach–Glendale, CA; Louisville, KY–IN; McAllen–Edinburg–Mission, TX; Memphis, TN–MS–AR; Miami–Miami Beach–Kendall, FL

Milwaukee – Waukesha – West Allis, WI; Minneapolis–St. Paul–Bloomington, MN–WI; Nashville – Davidson – Murfreesboro, TN; Nassau–Suffolk, NY; New Haven–Milford, CT; New Orleans–Metairie–Kenner, LA; New York–White Plains–Wayne, NY–NJ; Newark–Union, NJ–PA; Oakland–Fremont–Hayward, CA; Oklahoma City, OK; Omaha–Council Bluffs, NE–IA; Orlando–Kissimmee, FL; Oxnard–Thousand Oaks–Ventura, CA; Philadelphia, PA; Phoenix–Mesa–Scottsdale, AZ; Pittsburgh, PA; Portland–Vancouver–Beaverton, OR–WA; Poughkeepsie–Newburgh–Middletown, NY; Providence–New Bedford–Fall River, RI–MA; Raleigh–Cary, NC; Richmond, VA; Riverside–San Bernardino–Ontario, CA; Rochester, NY; Sacramento–Arden-Arcade–Roseville, CA; Salt Lake City, UT

San Antonio, TX; San Diego – Carlsbad – San Marcos, CA; San Francisco – San Mateo – Redwood City, CA; San Jose – Sunnyvale – Santa Clara, CA; Santa Ana – Anaheim – Irvine, CA; Sarasota – Bradenton – Venice, FL; Scranton – Wilkes-Barre, PA; Seattle – Bellevue – Everett, WA; Springfield, MA; St. Louis, MO – IL; Stockton, CA; Syracuse, NY; Tacoma, WA; Tampa – St. Petersburg – Clearwater, FL; Toledo, OH; Tucson, AZ; Tulsa, OK; Virginia Beach – Norfolk – Newport News, VA – NC; Warren – Farmington Hills – Troy, MI; Washington – Arlington – Alexandria, DC – VA – MD – WV; West Palm Beach – Boca Raton – Boynton Beach, FL; Wichita, KS; Wilmington, DE – MD – NJ; Worcester, MA; Youngstown – Warren – Boardman, OH – PA

SECTION E. DISAGGREGATED SEGREGATION MEASURES

Only one study of which we are aware, Omer and Benenson's (2002) analysis of Jewish – Arab segregation in a district of Tel-Aviv, foregoes aggregated units in favor of spatial relations among households; data and computational constraints usually preclude such an approach. Of course, households can also be considered population aggregations if they consist of two or more members. This fact is recognized by Wong (1998), who examines household racial composition as a solution to the scale sensitivity of *D* and most common segregation measures. His intrahousehold focus addresses another problem with these measures, based as they are on census tracts: the assumption that lower levels of segregation mean more intergroup contact and assimilation. Even in racially diverse neighborhoods, White and minority residents may exhibit distinct, homogeneous social networks in which one's own group dominates (see, e.g., Lee and Campbell 1999). According to Wong, the presence of persons from different racial groups in the same household (e.g., through intermarriage or adoption) more strongly supports the inference that significant integration is occurring. Ellis and colleagues (2007), however, warn that racially mixed households may complicate the interpretation of neighborhood-scale integration.

SECTION F. GIS TECHNICAL ISSUES

SMOOTHING. Pycnophylactic, or mass-preserving, smoothing (Tobler 1979) iteratively reestimates counts in each cell by assigning to that cell the average population count of the cell and its eight neighbors. At the same time, cell counts are repeatedly adjusted to maintain observed block-level counts. Because of concerns that pycnophylactic smoothing may exaggerate the similarity of racial patterns across block boundaries, we replicated portions of the analysis (1) without smoothing and (2) with an anti-smoothing procedure in place (so that the data are deliberately smoothed within blocks in a way opposite that of pycnophylactic smoothing). Both of these sensitivity tests confirm the robustness of our results. The results also hold irrespective of the size of the cells to which smoothing is applied; conclusions based on $25m^2$ and $100m^2$ cells match those reported in the article for $50m^2$ cells.

WEIGHTING. A formal definition (formula) for the biweight kernel proximity function can be found in Reardon et al. (forthcoming).

TRUNCATION. Metropolitan boundaries impose a limit on how far outward local environments can extend. By truncating the construction of such environments at the metro line, we risk slipping into a proximity "trap" analogous to the one identified as problematic in conventional research. Namely, truncation implies that residents of blocks at the outermost edge of a metropolitan area have no exposure to persons living in adjacent counties excluded from the official OMB definition of that area. The good news, from our perspective, is that the potential edge effect associated with truncation does not appear very large. For this effect to make a difference in estimated segregation levels, two conditions would have to hold: (1) dense populations must be in place just beyond metro boundaries, and (2) the racial composition of these populations must differ substantially from that of the nearby metropolitan population. Both conditions strike us as unlikely on logical grounds, a position confirmed by empirical assessment of edge effects in a small subset of cases from our metro area sample.

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Section G. Determinants of Segregation (Aspatial *H* and D) by Racial Group Combination

Group Combination/Predictor	Aspatial *H*	Group Combination/Predictor	Dissimilarity
Black–White		Black–White	
Northeast	.060*	Northeast	.060**
Midwest	.047	Midwest	.032
South	.205***	South	.151***
Metro population ($\log_{10}$)	.119***	Metro population ($\log_{10}$)	.096***
Proportion Black	.663***	Proportion Black	.420***
New construction	–.498***	New construction	–.438***
Retirement	.682*	Retirement	.742**
Military	–1.875***	Military	–1.454***
Manufacturing	–.441*	—	—
Intercept	–.437*	Intercept	–.092
Adjusted R^2	.724	Adjusted R^2	.726
Hispanic–White		Hispanic–White	
Northeast	.064**	Northeast	.078**
Midwest	–.025	Midwest	–.006
South	.011	South	.003
Metro population ($\log_{10}$)	.124***	Metro population ($\log_{10}$)	.097**
Hispanic/White income	–.358***	Hispanic/White income	–.405***
—	—	Government	–.612*
Intercept	–.289	Intercept	.239
Adjusted R^2	.417	Adjusted R^2	.412
Asian–White		Asian–White	
Northeast	–.010	Northeast	.018
Midwest	–.027	Midwest	.010
South	–.018	South	.003
Metro population ($\log_{10}$)	.054***	Metro population ($\log_{10}$)	.054*
Proportion Asian	.365***	Proportion Asian	.344**
Proportion Black	.139*	Proportion Black	.177*
Asian ownership	–.186***	Asian ownership	–.309***
—	—	Manufacturing	.413**
Intercept	–.117	Intercept	.144
Adjusted R^2	.407	Adjusted R^2	.343
White–Black–Hispanic–Asian		White–Black–Hispanic–Asian	
Northeast	.028	—	—
Midwest	.010	—	—
South	.110***	—	—
Metro population ($\log_{10}$)	.050*	—	—
Proportion Black	.554***	—	—
New construction	–.354***	—	—
Retirement	.405*	—	—
Military	–.917**	—	—
Intercept	–.115	—	—
Adjusted R^2	.728	—	—

Note: N = 100 metro areas; entries in columns are unstandardized regression coefficients.
* $p < .05$; ** $p < .01$; *** $p < .001$

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