

Report on USBC Segregation Measures
Peer Review
Michael J. White
Brown University
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As a member of the panel I have been asked to address four issues:

- (1) appropriateness of the measures
- (2) technical adequacy of the measures
- (3) other potential measures published in peer-reviewed publications
- (4) suggested improvements for similar calculations for the 2010 Census.

Summary Statement

Overall, the census report, *Racial and Ethnic Residential Segregation in the United States: 1980-2000*, is a commendable contribution. It accurately reflects the state of current knowledge. The calculations appear to be all correct. It provides a valuable benchmark for social science and public policy. It forms a solid starting point for companion analysis of the 2010 census with regard to residential segregation. I recommend continuing to produce and disseminate these several segregation statistics for US metropolitan areas.

Background

The study of residential segregation has a long history in social and demographic science, with formal analysis dating back to at least the mid-20th century. In addition to a series of important substantive studies published over the years by a wide range of scholars, many methodological studies have also been conducted. These studies have generally led to (a) a much improved understanding of the properties of existing residential segregation indices; and (b) the decision to promulgate an array of measures, which would tap various features of the residential landscape.

Key issues in any assessment of residential segregation measures include, but are not limited to:

- mathematical properties of indices and their behavior under varying conditions
- the choice of geography for segregation calculation
- the choice of population traits, especially ethnic groups
- the connection between overall measures and substantive interpretation

These issues are of continuing interest, but they are especially pertinent as settlement systems (and the relevant geography) change over time, and as national demographic composition changes. At the same time, improvements in theory and data-management technology may lead to new measures and approaches.

1. Appropriateness of the measures

The report entitled *Racial and Ethnic Residential Segregation in the United States: 1980-2000* by Iceland and Weinberg with Steinmetz (2003) {hereafter report} is based on 19 measures of residential segregation from the 2000 census and the two preceding decennial censuses. The report focused on five measures, taken to be leading indicators of segregation dimensions. Both the full

complement of 19 measures and the reduced set of five (5) leading indicators are appropriate. They are in keeping with the current state of knowledge.

These 19 measures are consistent with the wider set of measures that the research community has developed, analyzed, and placed into the public domain in recent years. They appear in Massey and Denton (1988) as well as the more recent update of that work based on 1990 census data (Massey, White & Phua, 1996). This list of 19 omits only the proportion of the group in the central city (PCC) used by these other articles.

2. Technical adequacy of the measures

These measures in the report are technically adequate. That is, they meet minimum standards of definition and calculation for some aspect of residential segregation patterns. Most have been used in the literature for some time. At the same time, each has its own features - some preferable, some not - that distinguish it from others. It should be noted that technical adequacy (and utility of substantive interpretation) hinges not only on intrinsic mathematical properties, but also on how the analyst deals with geography and population measurement (ethnic groups, undercount, etc.) Several publications in the peer-reviewed literature (James and Taeuber 1985; Reardon and Firebaugh 2002; Schwartz and Winship 1980; White 1986; White and Kim, 2004) discuss methodological criteria of segregation measurement and the performance of these indices according to such criteria. A recent synthesis (White and Kim, 2004, forthcoming) contains discussion of some of the key principles guiding index choice. This document also presents specific discussion of how indices (including dissimilarity, isolation, and spatial proximity of the five indices used centrally in the report) perform along these dimensions. A synopsis of my view of the five representative indicators of each dimension is below.

Dissimilarity: highly valued for historical comparability, ease of interpretation and correlation with other more technical measures; key deficiency is the limitation to dichotomies. Correlates very highly with the other measures usually taken to indicate evenness.

Isolation: Increasingly in use since 1980s; argues for continued use. Valuable for its interpretation as potential social interaction within and across groups. Correlates identically for dichotomies in the two-group exposure index used by Massey and Denton as a representative. Weakness: usually limited to dichotomies and sensitive to overall metro ethnic composition.

Spatial Proximity: Valuable for directly incorporating geographic distance into the measure. Interpretable in terms of function of distance. Calibration an issue.

Delta: Has some element of physical concentration represented. Correlates highly with the relative concentration index discussed by Massey and Denton. Cannot apparently adjust for differing physical (topographic density) aspects of cities.

Absolute Centralization index: straightforward and intuitive; incorporates spatial position to some degrees. I agree with the report that this measure (and others like it) may be "increasingly outmoded" as central point (CBD) proximity is of less value analytically and for policy.

The statistical technique of factor analysis (Massey and Denton 1988), as well as direct Pearson product-moment correlation and Spearman rank-order correlation, demonstrates a high degree of interrelatedness among many of these measures. Such is the nature of factor analysis. Thus, these remaining fourteen other measures do add some additional information, but it is modest beyond the factors. Note also that factors extracted "earlier" invariably explain more common variance than subsequent factors. Each of these indicator measures does a good job of standing for others. The subsequent factor analysis replicated for 1990 census data (Massey, White, and Phua, 1996) did show some very modest shifts in the intercorrelation of segregation indices, but much of the pattern also remained the same. It would be of some value to repeat the correlation/factor analysis for the 2000 data to see how the intercorrelation compares with 1980 and 1990. To be sure the stability of the dimensions is of some interest, although any potential changes arising from findings must be weighed against the value of continuity in using the indices chosen to represent 1980 segregation structure.

3. Other Measures that should have been included

In my view the report provided an appropriate treatment of the set of segregation measures for 2000, consistent with developments in the research literature:

a. metropolitan areas, as indicators of housing markets, were used as the macro-geographic units of interest.

b. census tracts were employed as the parcel on which segregation calculations were based. The research community has moved increasingly to tracts for several reasons: their properties as best proxy for neighborhoods, relative comparability in size, and scale with respect to inferential properties of sample data.

c. the metropolitan area average population (composition) distribution continued to provide the benchmark for several key indices. Most measures are normed with respect to that value, or they present a measure of statistical association with regard to deviation from metro-wide composition. Composition-dependent indices are an exception to this. Other exposure indices could be considered, but these are also composition-dependent, and including all pairwise comparisons would become unwieldy.

d. ethnic groups tabulated on the basis of race-origin characteristics and self-reporting still appear to be the best source of information on the ethnic composition and residential distribution of the population.

e. The 19 measures repeat those in the literature and used in earlier studies.

f. Neighborhood diversity. One often hears of an individual neighborhood described as "segregated" or "diverse." While the measures we describe are implemented at the city-wide level of geography, it is possible to extend the line of thinking to the individual neighborhood. Simply stated one can think of an individual neighborhood as more or less ethnically diverse, and similarly, more or less similar in composition to the city as a whole. Often it is not realized that neighborhood diversity (or integration) and metropolitan segregation are two facets of the same process or population distribution. It can be shown (White, 1986) that the entropy statistic very

conveniently aggregates a measure of neighborhood diversity (integration). Thus, using the entropy statistics, the analyst can calculate an index of diversity at the neighborhood level. This was illustrated graphically in the 1990 census for Southern California (Allen and Turner, 1991). In turn the relative deviation of each neighborhood from overall metropolitan ethnic diversity (entropy) is what is captured in the entropy statistic (White, 1986). Other indices have some of these features, although the capturing of "neighborhood diversity" and metropolitan segregation is perhaps best illustrated in the aggregation properties of the entropy index.

4. Suggested Improvements for 2010

a. Multi-ethnic character. Consider an approach that will more completely reflect multi-ethnic situations. Existing measures can be used in a number of ways that will pick up on the increasing variety of ethnic groups in US cities. Ethnic diversification would also potentially affect the choice of exposure indices. Any index based on contingency table summary statistics (White, 1986), can accommodate multiple ethnic groups distributed across many census tracts or other areal units. The entropy index, which can handle more than two groups in a single calculation, and which has several desirable formal properties, might be given further consideration. In particular the entropy index can produce a single index per metropolitan area for a set of ethnic groups of any number of categories. The entropy index also has the desirable property of decomposability, which lets the analyst use subgroups of ethnic categories (Reardon and Firebaugh, 2002; White, 1986).

b. Spatial measures. It is likely that research during the current decade, some of which exploits GIS, will enable more sophisticated measures of spatial configurations in the future. These should be considered to the extent that there is scientific consensus on the utility and interpretation of such new measures. The varying densities of residential environments (which influence some measures) might also be considered.

c. Census geography. Tracts should probably remain the basic small-area unit for segregation measurement. Metropolitan areas should remain the basic indicator of the relevant housing market. Give the range of scale and subdivision of metropolitan areas (and the fact that each geographic catchments area generations a different basis of segregation calculation), some consideration should be given to the appropriate set of metro area units for 2010 calculations. Along these lines, the growth of multiple nuclei, both in terms of multiple central cities and as added employment sites, should be considered.

d. Public web site. Continue the practice of placing reports and data on the Web. Use contemporary technology appropriate to electronic distribution in 2010.

The Census Bureau has provided an important service to the public and the scientific community with its segregation calculations and associated reports. It is my view that continuing such a contribution, much in line with the history of providing other key data and statistics on the social conditions in the United States, would be valuable.

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