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The Contributions of School Desegregation to Housing Integration: Case Studies in Two Large Urban Areas

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Abstract

This article examines a half century of housing and school segregation data in two large California school districts. Based on a review of both the methods and the substantive data available tracking the relationship between school and housing integration, the study reported here shows that very substantial school-level integration in these two districts was followed by equally substantial housing desegregation. The study relies on Theil's H as the most appropriate measure of social segregation because this measure can be used to study the integration of multiple groups and can be decomposed to document where the most severe isolation of particular subgroups is occurring.

Keywords

education policy, school desegregation, residential patterns, desegregation effects, research methodology

For more than a quarter of a century, scholars have been examining the relationship between school segregation and urban housing patterns. Work on this issue has been hampered by three important factors: (a) technical uncertainty regarding the most appropriate units of analysis and the appropriate statistical

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procedures for measuring the degree of subpopulation segregation, (b) the difficulty of securing and linking long-term data sets that permit truly longitudinal analysis of the problem, and (c) formulation of reasonable theoretical models that can be tested using available data. This study addresses these problems by assembling a half-century long data set covering school and housing populations, identifying the most appropriate statistical procedures, and testing the theoretical proposition that school desegregation is a leading indicator, predicting and possibly causing housing integration to follow. The research presented here covers in detail only two large urban school districts and, therefore, cannot reach definitive statistical conclusions. It does, however, clarify underlying theoretical and methodological issues and documents highly significant longitudinal changes in these districts.

The study combines ethnicity data from the last five decennial census reports with school enrollment data to track housing and school desegregation histories in two large metropolitan school districts in the same Census Bureau–defined metropolitan area in California. The study indicates that school desegregation is a leading indicator of housing integration. Moreover, as school desegregation in one of the two cities under study was implemented early and voluntarily (relying on busing minority students to previously White schools) and the other city school system was desegregated more slowly through a contested court order (relying on magnet school programs to attract White family volunteers), we are able to contrast the history of desegregation in the two cities to determine whether these school desegregation strategies might be differentially effective in changing residential patterns.

In addition, we demonstrate that measured segregation is more intense as smaller and smaller areas are defined as sampling units. We conclude that the census *block group* is the most appropriate unit of analysis. We also argue, in some detail, that the information theory index, Theil's H (which the SPSS® statistical package calls the uncertainty coefficient), is the proper statistical measure for this kind of analysis. While our conclusions should be viewed as provisional and suggestive, we look forward to larger studies relying on the techniques developed here.

Theoretical Framework

After the constitutional issue of *de jure* segregation had been settled in the *Brown* decisions (*Brown v. Board of Education of Topeka* (I), 1954; *Brown v. Board of Education of Topeka* (II), 1955), civil rights advocates, particularly in the North and West urged school desegregation on urban school systems as a strategy for overcoming persistent differences in the academic success rates of majority and minority racial and ethnic groups. Always controversial, desegregation was expected to work by providing minority students with access to higher quality school services and by overcoming debilitating social stigmas associated with extended exposure to racially isolated educational settings. Although the interracial achievement gap has been reduced to a statistically significant degree, it remains quite severe. Moreover, it is not clear how much of the reduction that has occurred is in any way related to desegregation (Douglas, 1997; Kersten, 1995). Substantial racial, ethnic, and particularly social class segregation continues to characterize most urban schools systems. Orfield's (Orfield, Gordon, & Civil Rights Project, 2001) work suggests a continuing trend toward resegregation and that in some school districts the decline integration, or what he calls *interaction exposure*, is getting progressively worse. With a national shift toward political conservatism, many have come to question whether the substantial economic and political costs incurred during school desegregation are producing any substantial social benefits commensurate with the price being paid.

The Limited Achievement Effects

Our interest in the impact of desegregation on housing springs directly from the growing awareness that desegregation of America's schools has resulted in, at most, modest student achievement gains for minority students. As the literature review below indicates, the evidence for even modest gains is far from clear. Given that more than 50 years that have past since the *Brown v. Topeka Board of Education* supreme court decision (1954) found "separate but equal" schools inherently unequal, one would expect more substantial evidence verifying the benefits of desegregation.

Alas! Such research does not exist. What does exist is a large body of work that reaches no consensus on the proposition that integration has resulted in increased student achievement. Beginning with the early and widely cited review by Crain and Mahard (1978), research on the relationship between desegregation and Black achievement has been viewed as equivocal. At the time their work was published, there were "over a hundred studies of achievement test performance following desegregation" (p. 17). Crain and Mahard take pains to emphasize that the investigation of achievement that focuses on standardized test results is embarrassing when contrasted with the number of studies that investigate the population movement aspects of desegregation (p. 17). A 1980 study found "that there was no statistically significant research from 1955-1977 which showed that desegregation influenced black student achievement positively" (Krol cited in Irvine & Irvine, 1983, p. 421).

In the early 1990s, Rumberger and Wilms (1992) concluded that "segregation can, but does not always, lead to achievement difference across schools and among ethnic groups" (p. 378). By the mid-1990s, however, the focus of research and scholarly argument shifted from achievement to the effect of desegregation on what Wells (1995) described as the "educational and occupational aspirations and attainment of African-American students" (p. 692; see also Rivkin, 2000; Trent, 1997).

Given the shifting focus of research attention and the lack of consensus across multiple studies undertaken over an extended period of time, it is fair to say that there exists no irrefutable evidence that school desegregation has resulted in increased student achievement for any group of students. Two widely read recent books summarize the evidence as follows:

> Studies that have sought to determine the effect of desegregation on the achievement of blacks have come up with a decidedly mixed set of results. In general, the research suggests no effect on mathematics achievement for blacks and some positive effect on reading for blacks. The achievement of Whites does not appear to be harmed. (Clotfelter, 2004, p. 187)

And, Hochschild and Scovronick (2003) conclude that

> Because so much else was changing at the same time, scholars do not agree on the extent of the impact on achievement of desegregation alone, although almost all agree that it did not hurt. (p. 39)

The Evidence on Housing: Cause or Effect?

Housing segregation—created by a combination of social class and racial biases in the housing market and often reinforced by the gerrymandering of school attendance boundaries—remains a potent factor influencing school segregation. By both facilitating and relying on school segregation, housing segregation plays a determining role in shaping educational opportunities and outcomes. If housing could be effectively desegregated, it would be possible for urban school systems to provide schools that are both *integrated* and *neighborhood based.* Hence, if it can be shown that residential housing patterns are substantially influenced by school desegregation, it might be argued that the benefits of school desegregation, though delayed, are substantial because they produce more integrated neighborhoods which will eventually produce more homogeneous educational opportunities and outcomes (e.g., Rosenbaum, 1995). In early research studies, this issue was discussed as *White flight*—a term reflecting documentation that at least some White residents were sufficiently opposed to desegregation of their schools that they were willing to sell their homes and move out of districts that undertook desegregation of their schools. As early as 1979, some researchers became interested in the question of whether, despite some White flight, school desegregation significantly encourages housing desegregation. Evidence from early studies was limited but encouraging. Pearce (1980), for example, provided some evidence that the existence of metropolitan desegregation policies significantly alters the behaviors of home buyers and real estate agents and alters public consciousness of the social, cultural, and economic character of the metropolitan area in ways that lead to racial integration (though probably not much socioeconomic class integration).

Historically, housing and school enrollments have been closely linked. Beginning in the early 19th century, school buildings represented community and neighborhood resources, which by the end of the century, were frequently designed to be welcoming or inspiring places for children to receive their formal education (Cutler, 1989). By the beginning of the 20th century, the school had become the focal institution for neighborhood and city planning, with the local elementary school and the "neighborhood unit" sharing the same defining boundaries (Cutler, 1989; Dewey, 1950; Gerckens, 1992). Though rarely discussed in current school or housing policy debates, following World War II, the neighborhood unit model for planning was criticized convincingly as an instrument for segregation (see discussion of Reginald Isaacs in Dewey, 1950). At the same time, secondary schools have always served larger areas, frequently requiring students to travel outside their neighborhoods and, thereby, creating a situation where their social ties and commitments are broadened and reorganized (Brussat & Riemer, 1951). Elementary schools, by serving small and compact catchment areas, virtually assured that school populations and neighborhood populations are drawn from the same groups. Hence, without making any judgment about the direction of causality, it would be nearly impossible for there not to be a very high correlation between school and housing segregation.

Moreover, school policies historically have been used to support the development of homogeneous and, therefore, segregated neighborhoods (see, for example, Armor, 1995; Moran, 2005; Orfield & Eaton, 1996; Rossell, 1990). This was recognized by the U.S. Supreme Court in the *Swann* (*Swann v. Charlotte-Mecklenburg*, 1971) and *Keyes* (*Keyes v. School District No. 1*, 1973) desegregation cases. The mechanisms used to achieve this segregation, beyond the *de jure* segregation in the old South, include drawing catchment area boundaries to define homogeneous population subsets, locating new school sites to favor specific neighborhoods, constraining or expanding school enrollment capacity (by building small school facilities or using relocatable/portable classrooms) to maintain neighborhood attendance patterns, and liberal (or restrained) school transfer policies to facilitate or constrain families' exercise of benign or insidious preferences. Of course, policy decisions could be used to transform these mechanisms into methods for promoting integration as easily as segregation. Additional strategies specifically designed to promote desegregation of neighborhood schools include school magnet programs, student busing, and lottery systems for charter schools and pairing of highly segregated schools to balance enrollment between pairs of formerly majority and minority schools. Clearly, there are a number of policy options school boards can adopt to affect the racial and ethnic composition within the schools they govern.

The persistent preference for neighborhood-oriented schools encourages consideration of neighborhood housing policies and their effects. Public and private policies affect the degree and persistence of the neighborhood residential segregation so often confounded with school segregation (see, for example, Anyon, 1997; Armor, 1995; Feagin, 1999; Massey & Denton, 1993; Orfield & Eaton, 1996; Varady & Raffel, 1995; Yinger, 1998). Restrictive housing covenants, determination of public housing sites, "red lining" (discriminatory lending practices), racial steering by real estate agents, "block busting" (racial panic pedaling in the real estate market), city planning, location of parks, freeways, and other socially important city elements, and zoning restrictions have all been used to segregate residential neighborhoods. Alternatives like scattered-site housing projects and rental subsidies, equal housing action groups, housing counseling, and incentives for integration are mechanisms that can promote housing integration. Though many discriminatory mechanisms are illegal now, their legacy is quite profound. Undoubtedly, in the case of physical structures and land use, the effects of historical practices persist to this day.

The central working hypothesis for the present study is that, at least in cities with diverse populations like those found in the Southwestern United States, especially California and Texas (Frey, 2001, 2002), school desegregation can be expected to have substantial and sustained impact on housing integration and that this effect is most pronounced in the neighborhoods immediately surrounding schools that have undergone significant integration as a result of school enrollment policies. In addition, it is hypothesized that the nature of the desegregation policy adopted by a metropolitan school district has a significant impact on the timing and possibly on the extent of this effect. A voluntary and comprehensive plan might be expected to speed up housing integration and lower White flight more effectively than magnet schools created in response to a court order.

There are a number of important reasons why explicit school desegregation actions might be expected to facilitate housing integration. First, the immediate effect of school desegregation (whether through busing, magnet schools, or redrawing of attendance boundaries) is to increase face-to-face contact and interaction between children and families of different ethnic groups. To the extent that racial segregation is grounded in fear or anxiety about rather than actual negative experiences of other races and cultures, this immediate experience could allay this anxiety leading to greater willingness to live and work in integrated settings. Second, if all schools in a district are desegregated, even families that continue to prefer segregation will find it impossible to rely on schools to reinforce their preference and thus will, to some extent, be pressured to select residential neighborhoods on grounds other than race (unless, of course, they take the more drastic step of flight from a district they would otherwise want to live in). Third, when a community undertakes comprehensive school desegregation, they generate normative pressure on community members to accept cross-cultural experiences and to overcome (or at least suppress) fear- and anxiety-based racism. Fourth, to the extent that racially isolated schools lead to inequalities in educational programs, school integration will remove this factor from the repertoire of real estate agent sales pitches and family presumptions about the sources of school quality and thus remove school racial composition as a factor in families' reasonable searches for quality schools. Fifth, both housing and schooling integration may respond to broader community feelings about the significance of ethnicity as an important basis for choosing neighbors or school classmates for children. If, as we document below, school composition is a leading indicator of housing changes, it may be simply the result of the fact that schools are an easier target for community change than are real estate purchases. To the extent that this is true, school integration may be only a predictor of housing integration rather than a causal force.

There may be other reasons why school desegregation facilitates or encourages housing integration. Our purpose here is not to test what explanatory factors are producing the links between school desegregation and changed housing pattern changes but to ascertain whether changes in school composition are, to a statistically reliable level, leading indicators of changes in residential housing patterns. It will remain for future studies to untangle alternative explanations.

Design and Method

Measuring the extent of racial and ethnic segregation, particularly when there are more than two ethnic groups to consider and when trying to identify longitudinal changes, continues to pose significant problems. The Census Bureau has made significant changes in the way race data are categorized making confident classification across decennial tabulations difficult. Moreover, there are clear technical flaws in the earliest and most popular statistical indices (the Gini Coefficient and the Dissimilarity Index). Finally, changing the size of the study areas chosen for analysis substantially affects the measured level of segregation (and it is therefore uncertain whether one should use census blocks, block groups, tracts, postal zip codes, school attendance boundaries, or some other size of study area). If the study area is too small, then racial isolation will be nearly perfect (as would happen if individual households were studied). If the areas are too large, highly segregated neighborhoods will appear integrated because they are combined with adjoining neighborhoods with different population profiles.

Grannis (2005) explores in some detail the question of appropriate census area sizes to construct meaningful neighborhood communities. He concludes that the census block groups are thoroughly aligned with ordinary definitions of neighborhoods, whereas tracts are not, and that neighborhoods are generally composed of rather small clusters of block groups (see also Iceland & Steinmetz, 2003). Therefore, to compose predefined areas of a size appropriate to neighborhood-level studies, adjacent block groups should be selected as geographic neighborhoods. A neighborhood is never smaller than a block group and is almost always consistent with block group boundaries defined by the Census Bureau.

Once census categories have been disentangled and racial indicators and appropriate study areas have been identified, it is necessary to consider what statistical procedures to use for analyzing desegregation changes. Although this article was not meant to become a treatise on the viability any of the numerous methodologies used to measure segregation, it is necessary to add some context with respect to segregation indices. An understanding of the many ways that segregation can be measured does much to explain the measurement tools used in this article.

Prior to 1955, there was a lively debate around the measurement of residential segregation (Massey & Denton, 1988). Duncan and Duncan (1955), by proving that the existing measures were all basically subsets of the index of dissimilarity, ushered in what Massey and Denton called the *Pax Duncana,* a period during which the Dissimilarity Index became the *de facto* standard method for quantifying segregation (p. 281).

This peace was ended by a critical appraisal of the Dissimilarity Index authored by Cortese, Falk, and Cohen (1976). Massey and Denton (1988) present the segregation index wars in some detail. The primary result of this review is their recognition of the essentially multidimensional character of residential segregation measurement. The result of this work was the identification of 20 different indexes of segregation. These indices were classified with regard to how they treat five distinct dimensions of segregation (Iceland, Weinberg, & Steinmetz, 2002). Those dimensions (evenness, exposure, concentration, centralization, and clustering) are explained as follows:

> Evenness involves the differential distribution of the subject population, exposure measures potential contact, concentration refers to the relative amount of physical space occupied, centralization indicates the degree to which a group is located near the center of an urban area, and clustering measures the degree to which minority group members live disproportionately in contiguous areas. (Appendix B, p. 119)

As we are interested in geographical segregation across school and census areas, our focus in this study is on the evenness measure. Blau (1977) defines evenness as the differential distribution of social groups among areal units in a city or other region. A minority group is said to be segregated if it is unevenly distributed over areal units. Answering the central question raised in this study, where non-White residents include large numbers of Hispanics, Asians, and Others as well as African Americans, means we must ascertain not only the extent to which Whites are segregated from non-Whites but also the extent to which this segregation is more or less severe than the segregation separating the major minority groups from each other. To do this, we needed an index of segregation that could be partitioned to show whether existing segregation is primarily the result of White/non-White separation or whether other ethnic divides are similarly severe. As shown by Reardon and Firebaugh (2002), measuring segregation across a variety of groups is best accomplished using the entropy or information index developed by Theil (1972). His entropy-based Information Index readily generalizes to multigroup cases, provides standard error estimates to assess statistical reliability (described in the SPSS© manual), and can be decomposed in ways that distinguish which census subareas and/or which population groups display most intense segregation (Pielou, 1972; Reardon & Firebaugh, 2002; White, 1986).

Theil (1972), using the concept of entropy drawn from physics, produced an "Information Index" that has a straightforward meaning and a relatively simple mathematical algorithm. Theil's index links two basic ideas—a measure of disorder that applies to any area or container that has a mixture of elements and an assessment of whether subareas (or subcontainers) are more or less homogeneous than the larger set to which they belong. He begins by showing that physical entropy is a general measure of the disorder in any context involving a mixture of distinct component elements. The extent of entropic disorder is given by the equation,

$$\text{Entropy} = \sum_{\text{groups}} p_g \times \text{Log}\left(\frac{1}{p_g}\right)$$

where p_g is the proportion of the total population drawn from each different group g (If $p_g = 0$, the Log term is set to zero as that subgroup adds nothing to the overall entropy measure).

This entropy calculation has a minimum value if all the individuals in a given study area are drawn from the same social group. It reaches a maximum value if the membership of a study area has equal representation from all groups. Of course, equal representation is almost never realized because the various groups under study are typically not of equal size in any region we wish to study. Thus to make a realistic estimate of the extent to which the different groups in the total population are unevenly distributed within any larger area, Theil needed to introduce a second key concept—a method for comparing the entropy in individual observational areas with the entropy of the entire region within which they are located. This calculation reveals the extent to which observational subareas have population mixes that are *proportionally representative* of the entire region.

This second idea leads to what Theil called an *Information Index* because it measures how much we know about the probable subgroup identity of individuals based on the observational subarea in which they are located. That is, the Information Index measures the extent to which knowing a subject's area of residence enables us to predict their membership in a particular population subgroup. The weighted sum of the ratios of the subarea entropy to the total regional entropy (summed across all observation subareas) produces a precise measure of the extent to which the entire region under study lacks proportional representation of all population subgroups in each of the region's observational subareas. By Theil's Information Index, any region composed of observed subareas is thus calculated by the formula

$$\text{Information}(H) = \sum_{\text{areas}} p_a \times \left(\frac{E_{ttl} - E_a}{E_{ttl}}\right)$$

where E_{ttl} is the total entropy for the entire region, E_a is the entropy of each subarea, p_a is the proportion of the total population in each subarea.

The value of H can vary from 0 to 1. It has a value of 0 when the subgroup proportions in every observational subarea is the same as the subgroup proportions in the entire region. It has a value of 1 when each observational area is occupied by a single subgroup while the entire region has representation from more than one subgroup. Thus H is the proportional improvement in our knowledge of an individual's group membership if we know which observational subarea they reside in. The SPSS calls this index the *uncertainty coefficient*. This is a bit counterintuitive, as our uncertainty about predicting an individual's identity based on their location actually *decreases* as the value of this index increases; hence, we preserve Theil's Name: Information Index. For an excellent example of how to apply Theil's index to educational data, see Reardon, Yun, and Eitle (2000).

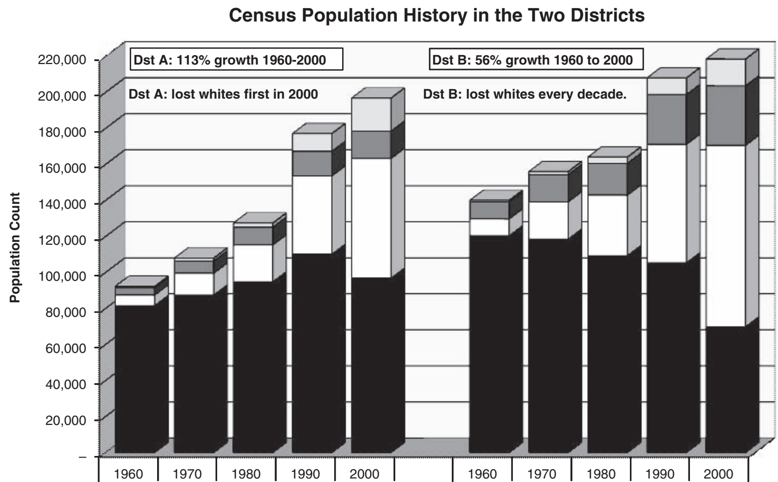
As standard errors can be readily calculated for Theil's index, it can be used to estimate the probability that identified segregation levels are the result of sampling bias rather than true segregation within the populations under study. By estimating both the magnitude and the reliability of measured segregation across multiple groups, Theil's Information Index becomes the most appropriate approach to statistically tracing longitudinal changes in the segregation levels found in both school and housing populations.

One point that may not be entirely obvious deserves to be noted here. Theil's H defines perfect desegregation not when each subarea has equal representation from all population subgroups but rather when each subarea has the same proportion of each population subgroup as is found in the entire region under study. Thus, if we confine our attention to the boundaries of a city largely populated by a single ethnic group, full desegregation of that city will be found when every ward, census tract, or other subarea contains the same proportion as the city as a whole. Or, in the case of schools within a single district, complete desegregation of the district would be declared by Theil's H when the school district has succeeded in enrolling the same proportion of each ethnic group in every school, even if the district population consists almost entirely of a single ethnic group. This means that using the Information Index criterion, school districts would be accountable for creating schools that distribute proportionally the population within the district boundaries not for creating schools that have equal size subgroups or that reflect state or national proportions. This might initially seem like a weak standard, but as Theil's analysis can be applied to any size region, it can be used to assess the extent to which ethnic segregation exists *between* rather than *within* local school districts and thus can determine the extent to which desegregation is beyond the capacity of district policy makers. Moreover, Theil's H can be statistically decomposed to show exactly how much the total segregation found in a county or state region depends on the segregation between school districts and how much is manifested within each of the districts. Thus, Theil's H can be used to properly place the burden of responsibility for managing desegregation onto those governmental units that can realistically bear responsibility for the outcomes—districts can be held accountable for within-district segregation whereas counties, states, or the federal government can bear the responsibility for between-district segregation.

Data Presentation Steps

The analysis presented below proceeds in four steps. First, we review briefly the population histories of the two school districts under study. Both the residential population and the school enrollment histories are summarized to provide a broad overview of the districts and their approaches toward school desegregation. Second, we trace the housing and school desegregation histories of the two districts, documenting substantial housing integration and dramatic school enrollment desegregation progress over the four decades between 1960 and 2003. Third, we briefly compare the degree of population segregation found across census blocks with estimates made when block groups, census tracts, or school neighborhoods are used as the unit of analysis. Finally, we tackle directly the central question of this study: Is school desegregation a leading indicator of housing integration? The specific methods used in each step of this process are presented as the findings are described.

Data sources. Data for this study come from four sources, the National Center for Educational Statistics' Common Core Data (NCES—http://nces.ed.gov/ccd/bat) which reports on the ethnic enrollment in all California public schools beginning in 1981 (these data are identical to those available from the California Department of Education's Basic Education Data System [http://dq.cde.ca.gov/DataQuest/downloads/sifenr.asp] but are slightly easier to access on the NCES Web site). For school enrollment prior to 1981, we found two data sources for selected years: The U.S. Office of Civil Rights published four school enrollment reports for the years 1967, 1968, 1970, and 1976, and Hendrick (1968) reports school-level data in his study of desegregation of the district we refer to as District A throughout this study. He provides 1964 and 1967 enrollment numbers for that district. The fourth data source is the five decennial census reports generated by the U.S. Census Bureau for 1960 through 2000 (http://factfinder.census.gov). The school data are collected for each of the years aligned with the federal census data and for every 2nd year during the interval between census periods. Data for the years up to 1980 are less detailed in two ways: residential census data for 1960 and 1970 can only be easily accessed at the tract rather than the block and block



	1960	1970	1980	1990	2000		1960	1970	1980	1990	2000
	District A						District B				
Other	622	1,553	2,288	9,816	18,375		834	1,683	3,451	9,223	14,846
Black	4,191	6,827	9,873	13,741	15,158		9,512	15,131	17,696	27,663	33,122
Hisp	5,844	12,098	20,503	43,417	66,480		9,339	20,649	33,597	65,789	100,71
White	81,661	87,559	94,854	110,22	96,872		120,43	118,63	109,39	105,42	69,913

Figure 1. District population histories

group levels, whereas block group data are used for the 1980 through 2000 census periods and block level data from the 2000 census were examined. To standardize units of analysis for population segregation throughout the study period, we used ArcView© GIS software to redistribute the population counts from each census period to the geographical areas identified as census block groups in the 2000 census.

A second limitation on the data is that school data for the years prior to 1976 do not distinguish Hispanic students as a unique ethnic group but lump them in with all "other" students who are neither White nor Black students. The Hendrick (1968) study provided the Hispanic counts for school enrollment for District A in 1964 and 1967 but not for District B.

Results

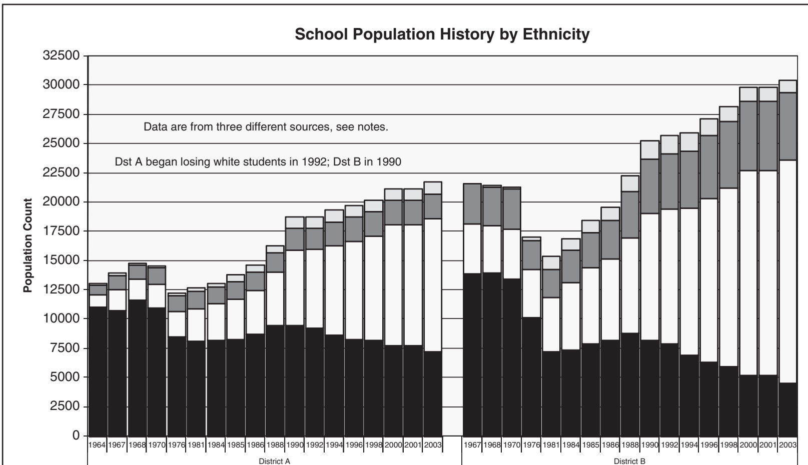
Residential history. Figure 1 presents the official population histories for both of our study districts as reported by the Census Bureau in the five decennial census counts from 1960 through 2000. Five features of the data on this graph provide significant insight into the development of these two districts. First, over the 40 years from 1960 to 2000, the growth in each district's overall population count is dramatic (113% growth for District A and 56% for District B).

Second, the largest segment of population growth in each district has been in expansion of the number of residents of Hispanic descent. The proportions of the African American and the Other (mostly Asians) groups have also grown significantly but not nearly as dramatically as the Hispanic population growth. Third, each of the districts under study has experienced an absolute decline in the number of Whites within the district. District B lost White residents during each of the four decades following the 1960 census, whereas District A increased in the number of White residents (though a reduction in their proportion of the entire population) during each census period prior to 2000. Fourth, the Other population group which includes all residents of Asian descent has grown very dramatically in the last 20 years, especially in District A. Finally, though District B had about 1.5 times as many residents as District A in 1960, their total populations differed by only about 10% in 2000.

School population history. The ethnic composition of the public schools in the two school districts in the years from 1964 through 2003 is shown in Figure 2. Two features of this graph deserve special note. First, the data collected by the Office of Civil Rights reports larger school populations in both districts than that found in the official 1981 population report when the current California data system was put into place. A review of national school enrollment data show a dramatic nationwide decline in public school enrollments between 1971 and 1984 (fully a 14.9% drop in total enrollment, Snyder, Tan, & Hoffman, 2006, Table 63, p. 96). This, combined with the White population decline in District B, may account for the enrollment count discrepancy, but we could find no public records for the two study districts that confirm that they reflected national enrollment trends.

We did identify four schools reported in the OCR data that disappeared for some time in the early Common Core Data reports but reappear a few years later in this data. We take some comfort that the proportions of non-Whites in the earlier data are similar to those found in the early years of the current data system, which means that the contrast across the school data points will probably not seriously distort the measured degree of school segregation.

The second feature to note in this graph is that, beginning sometime between 1976 and 1980 and for the remainder of our study period, a dramatic growth in non-White students makes up nearly all of the school district enrollment growth. This growth is parallel with, but more dramatic than, the



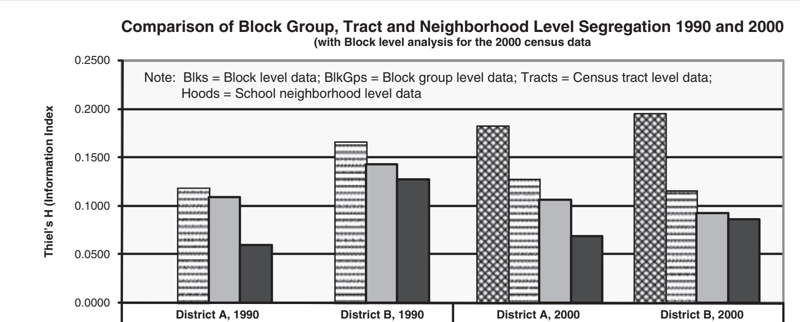
District A	1964	1967	1968	1970	1976	1981	1984	1985	1986	1988	1990	1992	1994	1996	1998	2000	2001	2003
Other	129	185	130	141	185	318	299	584	581	628	947	977	1026	985	954	939	939	1062
Black	798	1170	1170	1392	1360	1462	1449	1524	1547	1651	1836	1811	2042	2072	2103	2159	2159	2092
Hisp	1035	1826	1824	2043	2213	2815	3117	3397	3758	4528	6441	6757	7583	8351	8884	1029	1029	1136
White	1107	1074	1164	1095	8473	8096	8203	8286	8721	9479	9505	9242	8678	8307	8220	7757	7757	7258

District B	1967	1968	1970	1976	1981	1984	1985	1986	1988	1990	1992	1994	1996	1998	2000	2001	2003
Other	na	132	186	246	1064	1001	1042	1109	1346	1594	1591	1523	1445	1312	1153	1153	1065
Black	3406	3293	3399	2503	2458	2770	2987	3324	3964	4624	4746	4886	5338	5657	5948	5948	5767
Hisp	4301	3996	4299	4122	4629	5786	6500	6929	8162	1087	1151	1262	1402	1524	1752	1752	1910
White	1389	1399	1342	1013	7207	7357	7894	8232	8799	8197	7880	6894	6341	5983	5192	5192	4497

Figure 2. Elementary school ethnic composition from 1964 to 2003

residential population growth shown in Figure 1. Though there was significant school enrollment loss between 1970 and 1976 in both districts, the current pattern of continuing White student loss started in about 1988, with the loses in District B substantially steeper than those in District A.

Selecting subarea units for study. Before examining the segregation history in the two districts under study, we need to take a short detour and ask whether it makes a difference whether we use school catchment areas, census tracts, block groups, or blocks to assess the degree of segregation found within a school district. Typically, segregation researchers have used either school catchments or census tracts for their analysis. We did not find any school desegregation studies that compared the levels of segregation found when larger or smaller subarea units are used to make statistical tests. The polygons outlining the smaller block group and block level counts are not available electronically for the 1960 and 1970 census years, and so we were forced to rely on census tract data for these 2 years. In addition, school catchment areas are not available electronically for any of the study years. We compensated for this limitation on the data by creating estimated school catchments from the 2000 census block group polygons. This was done by calculating the distance between each elementary school's location and the geographic



Blks Dst A		0.1831
BlkGps DstA	0.1195	0.1280
Tracts Dst A	0.1087	0.1063
Hoods Dst A	0.0595	0.0683
Blk Dst B		0.1962
BlkGps Dst B	0.1663	0.1163
Tracts Dst B	0.1430	0.0927
Hoods Dst B	0.1277	0.0861

Figure 3. Changes in estimated segregation as observation area changes

centroid of each block group polygon and then assigning each polygon to the closest elementary school. This creates catchments in which the school is more or less centrally located with respect to the 2000 census block groups and, therefore, necessarily miss-locates neighborhood boundaries in cases where schools were not located at or near the center of their catchment areas. These errors could actually be viewed as improving the study if we consider that the expected link between school and housing segregation depends on the physical neighborhood rather than school catchments created by school administrative decisions.

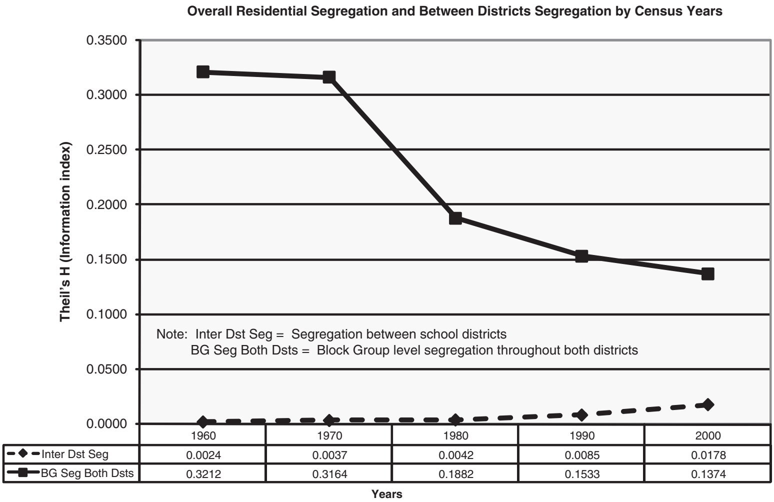
Taken together, the two school districts in the study are composed of 68 school neighborhoods (one for each elementary school in the two districts). Within the two districts are found all or part of 104 census tracts, 342 census block group polygons, and 6,378 census blocks. The total population of the two districts in 2000 was 415,482. This means that, in that year, the average neighborhood group was 6,110 individuals, the average tract size was 3,995, the average block group was 1,214, and the average census block contained just 65 individuals of all ages. Figure 3 reveals the dramatic differences in the measured levels of segregation that are found as we move across subarea sizes. Shown on this graph are the Theil's H values for each of our study districts, including block group, tract, and constructed neighborhood areas for both the 1990 and the 2000 census counts and census block counts from the 2000 census. The first point to notice about this graph is that each time a larger observation area is used, the estimate of segregation is reduced significantly.

Notice, for example, that the block level estimates of segregation (shown only for the year 2000) are about 50% larger than the block group level estimates (.1831 to .1280 for District A and .1962 to .1163 for District B). Differences between the block group, tract, and neighborhood estimates are much smaller (though still statistically significant at the $p < .001$ level). Also notice that, by all measures District A was less segregated than District B in 1990. In 2000, however, District A appears more segregated than District B at the block group and census tract level but somewhat less so when the measurements are made at the block and neighborhood levels (all differences are significant at the .001 level).

Having discovered these differences, we examined whether longitudinal trends appear to have different shapes depending on the subareas used to count residents. Since the trend lines (not shown) are virtually identical, we settled on using the block group level census counts to study residential segregation. These counts are based on areas that typically hold an average of between 600 and 3,000 residents (Iceland & Steinmetz, 2003, p. 1), large enough to easily allow for residential mixing but small enough to improve the accuracy of our estimates.

Block group level segregation history. Figure 4 begins our analysis of the historical evolution of ethnic segregation of the residential populations in the two districts from 1960 to 2000. Two lines are plotted on this graph—the top line shows the Information Index for block group level segregation across the entire two district region found at the time of each decennial census report.

The Theil's H value of .3212 at the start of the top line on the graph indicates that in 1960, segregation at the block group level in both districts was such that a little more than 32% of the residential composition of each census block group area was determined by imbalances in the proportional distribution of ethnic group members among the block group areas within the entire region covered by these two school districts. That is to say, uncertainty regarding which ethnic group a resident belongs can be reduced by 32% if we know which census block group that person lives in. This is equivalent to saying that the members of each of the four ethnic groups under study are distributed in such a way that 32% of them are causing the census block group in which they live to deviate from what would be found if every block group area had the same proportional representation as the two district area taken as a whole. In 1960, the combined two district area was 87% White, 7% Hispanic, 6% Black, and 1% Asians and Others, which is the composition each block



	1960	1970	1980	1990	2000
Inter Dst Seg	0.0024	0.0037	0.0042	0.0085	0.0178
BG Seg Both Dsts	0.3212	0.3164	0.1882	0.1533	0.1374

Figure 4. Overall residential segregation and between district segregation 1960 to 2000

group would have if all residents in the region were as fully integrated as possible in this particular locale.

The bottom line on the graph tracks the extent to which the ethnic composition in each of the two districts deviates significantly from that of the region as a whole. The very small Theil's H in 1960 (H = .0024, $p < .001$) is statistically significant indicating that the two districts were already composed of somewhat different population profiles at the start of our study period. This between-district segregation is very small, however, when compared with the region-wide block group level segregation traced by the upper line on the graph.

In the years since 1960, the degree of block group segregation has dropped by nearly two thirds, reaching H = .1374, $p < .001$ in 2000. During the same period, the two districts have increasingly diverged from each other in overall ethnic composition. District B started with a somewhat larger non-White population and became increasingly non-White by the end of the century. District A was just 12% non-White in 1960 compared to District B's 14%. By 2000, District A had reached 51% non-White, whereas District B's non-White population rose to 68% of all residents in the district.

Comparing the districts. In Figure 5, we have separated the two districts to independently examine the evolution of ethnic group segregation within the

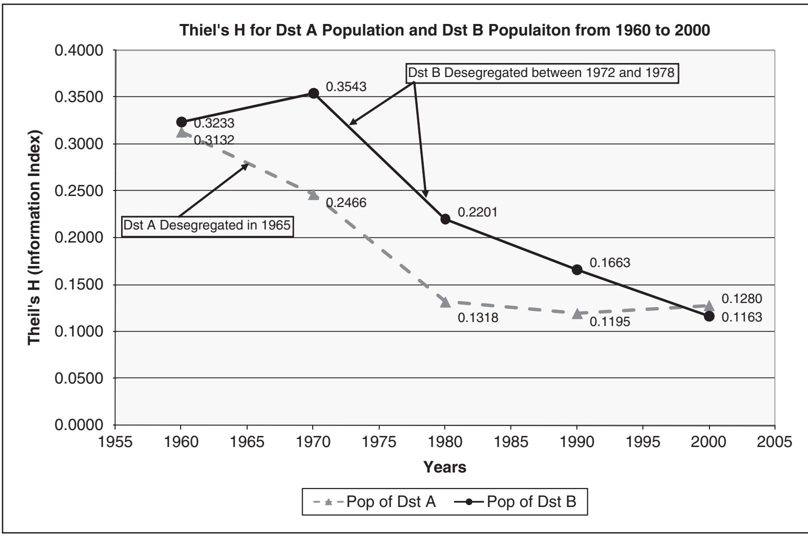


Figure 5. Residential segregation 1960 to 2000 in each school district

residential populations of each school district. This graph paints a picture of significantly different housing integration histories within the two districts.

They began with similarly high segregation levels in 1960 (H = .3132 for District A and H = .3233 for District B). However, District A started a process of substantially reducing segregation shortly after 1960. The housing segregation decline continued during the 1970s and 1980s. Housing segregation in this district began to rise again, however, between 1990 and 2000. In a contrasting history, District B experienced a significant increase in residential segregation between 1960 and 1970, but began a dramatic decline between 1970 and 1980 with a significant continuation in residential integration over the last two decades of the 20th century, ending with a level of residential segregation that was significantly ($p < .001$) below that of District A. As noted on the graph, in 1965, District A began a voluntary desegregation plan, relying on busing minority students to predominately White schools. Desegregation of the public school system in District B did not begin until the mid-1970s. This district was taken to court to force desegregation in a case that took several years to resolve. The district used magnet schools, redrawing catchment areas, and voluntary transfer of students to desegregate its schools.

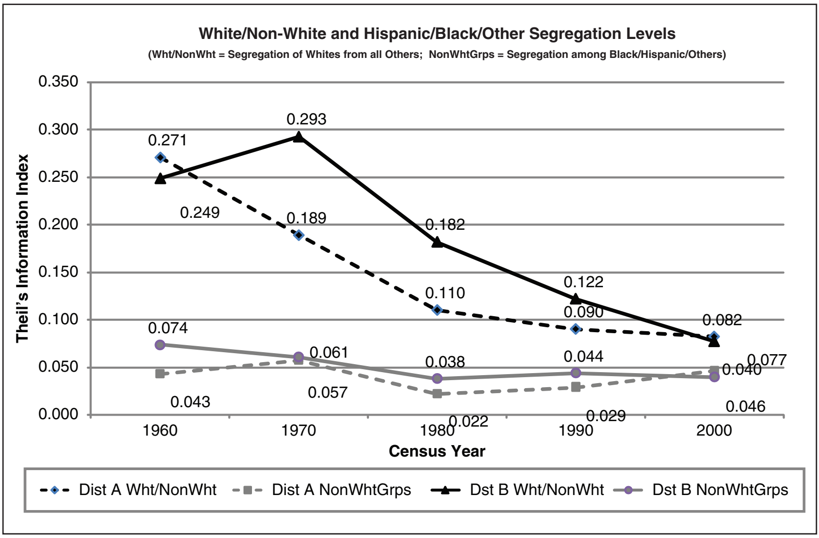


Figure 6. Partitioning the information index to distinguish White from non-White segregation

White versus minority segregation. In Figure 6, we have partitioned Theil's Information Index to distinguish the level of segregation among minority groups (Black, Hispanic, and Others) from the extent to which measured segregation is the result of residential separation between Whites and all non-White population groups. The top two lines trace White versus non-White segregation whereas the lower two lines trace the history of segregation among the minority residential groups. It is readily apparent in this chart that in each census count, between 64% and 86% of all measured segregation was the result of residential separation between the Whites and all non-White groups. Indeed, the White versus non-White lines in Figure 6 follow very closely the overall desegregation pattern seen in Figure 5 indicating that the desegregation processes in these two school districts were primarily effective in reducing the isolation of White residents. It is also important to observe in this chart that the level of White versus non-White separation was still about twice the level of separation among the non-White groups at the end of the study period. Thus, even in these very diverse school districts, desegregation has always been primarily about the separation of White residents from all other population groups.

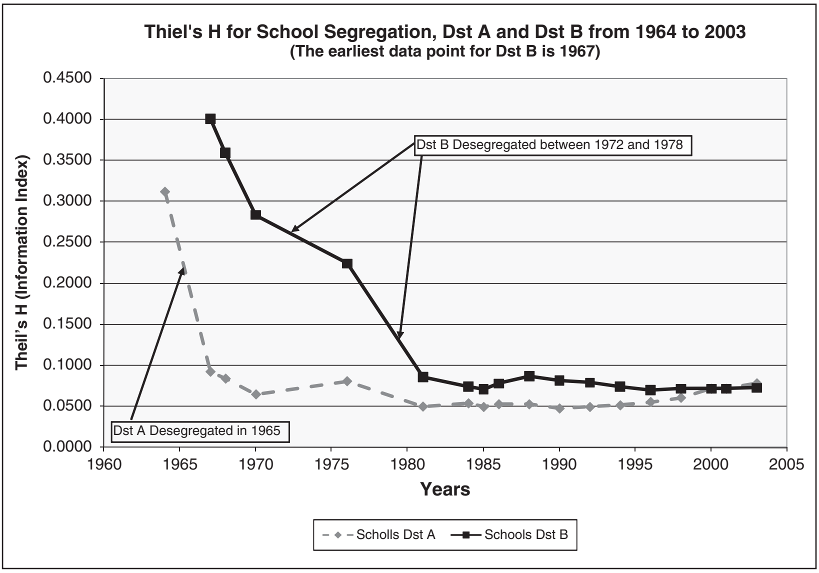


Figure 7. Elementary school segregation history from 1964 to 2003

Elementary school segregation. Figure 7 shows the segregation history of the student populations in the two districts' elementary schools. There are many more data points on this graph because school population counts are taken more frequently.

It is obvious from an inspection of Figure 7 that the school histories were closely related to the desegregation policy decisions taken in each district. District A's segregation level, which was somewhat lower than that in District B in our earliest records, reduced its Information Index score by more than two thirds between 1964 and 1967 (from .3126 to .0927; probability of significant change < .001). District B began to make substantial reductions in school segregation even before the court case was litigated, but desegregation of the schools accelerated during the decade of the 1970s as the desegregation suit was working through the courts. Since 1980, both districts have maintained a moderate level of segregation, with District A having the least school segregation until the year 2000. District B's segregation rose briefly in the late 1980s but fell steadily through the 1990s and into the present century. District A's segregation index was virtually flat throughout the 1980s but has been rising steadily since 1993 and is now above that of District B.

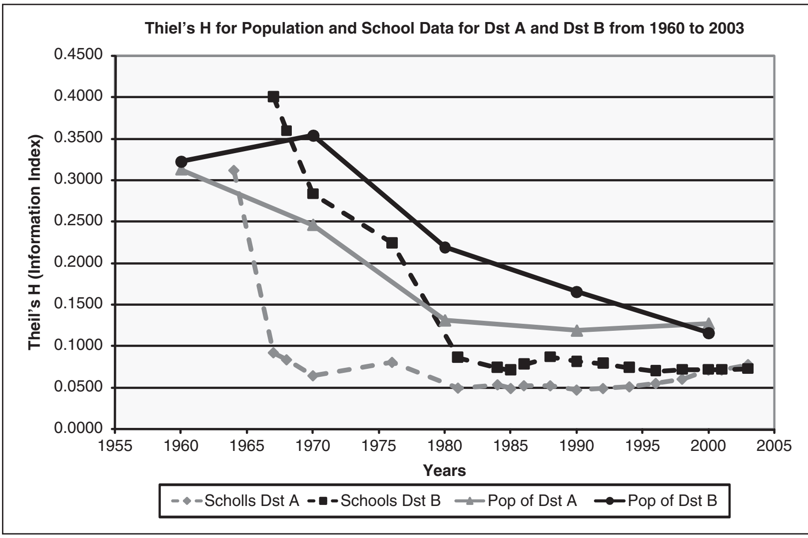


Figure 8. Overlay of school and residential segregation indices

Residential and school segregation compared. Figure 8 juxtaposes the residential and school segregation histories on the same graph, highlighting the time sequence relationship between the two desegregation processes. The most important thing to note about this graph is that, for each of the districts, the school desegregation lines are consistently to the left and below the residential lines throughout the period from 1968 to 2000.

Also note that for each district, the Theil's H values for school segregation during the years prior to the beginning of serious desegregation efforts were higher than residential segregation, indicating that at the beginning of our study period, the school systems were more thoroughly segregated than were the housing markets within the two districts. This is particularly striking since, as noted earlier, the larger areas covered by school attendance areas would typically be expected to show a lower segregation rate than the smaller census block group areas.

The important question is whether the data on this chart indicate that school desegregation is, in fact, a leading indicator of residential desegregation. As the data points for each type of segregation are not collected in the same years, it became necessary to test the lagged indicator hypothesis in two steps. First, we used the loess procedure in the SAS® statistical analysis

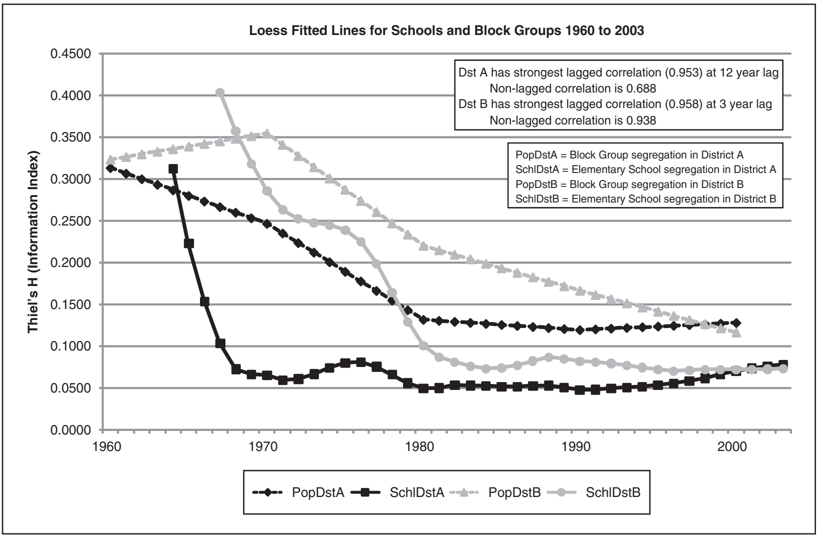


Figure 9. Loess smoothed curves for residential and school segregation

system to create smooth curves fitting as closely as possible the data points in the Figure 8 graphs. Then we generated pairs of estimated data points for each year along the smoothed curves. With the resulting set of matching, year by year, estimates of residential and school segregation levels, we were able to calculate the correlation between school and residential segregation and to determine whether school desegregation predicts housing integration by testing whether a lagged correlation coefficient (moving the residential data points back in time one or more years) is larger than the synchronous correlation between school and residential indices. Figure 9 presents a graph of the loess smoothed lines.

As shown in the text box on the graph, as expected, there is a strong synchronous correlation between residential and school segregation (.688 for District A, .938 for District B). More important, however, the correlation goes up significantly as the residential desegregation values are lagged from 3 to 12 years. For District A, the maximum lagged correlation reaches .953 when the school segregation indices are tested against residential data lagged by 12 years (in fact, the correlation increases each year of additional lagging up to the 12th year). For District B, the correlation moves up only modestly from .938 to .958 when residential segregation data are lagged 3 years. The correlation is very high to begin with; however, this small increase represents a statistically significant ($p < .001$) improvement in the predictive power of the school Information Index.

Discussion

Three conclusions are supported by the data presented in this study—conclusions corresponding to the objectives described in our introduction. First, the data demonstrate that prior to school desegregation in each of the school districts under study, both school and housing segregations were very high, far beyond any pattern that might arise through a random settlement or school assignment process. Although school catchment areas do not come very close to matching census block group boundaries, they display racial isolation patterns that are, in some cases, higher than the very substantial segregation in many housing blocks. Over the four decades following school desegregation, both school and housing patterns became substantially more integrated. Integration improvements came most rapidly during the 1970s and 1980s. Although one of the two cities in the study has been persistently more segregated than the other (the one that waited for court ordered desegregation), both cities have developed substantially more integrated housing and school systems than they had in 1970.

Teasing out the extent to which school desegregation is a leading indicator for housing integration is more difficult and less reliable when we have only two cities and the housing data are collected only once a decade. The data demonstrate, however, that the combination of societal changes and school desegregation policies was quite effective—reducing segregation to less than 20% of the preintegration levels and maintaining effective school integration for more than 30 years. The housing data show that residential desegregation took more than two decades but eventually stabilized at a level that is approximately twice that of the schools in both school districts. School desegregation is thus shown to be an important factor and a reliable leading indicator of changing city residential patterns. The fact that it is a “leading indicator” does not, of course, mean that it has caused the housing integration. Perhaps, larger social forces, community leadership, or policies not examined here were the truly causal forces, but the data reviewed here do show that, for these two districts at least, school desegregation came earlier and was more complete.

The relative effectiveness of voluntary busing and court-ordered magnet school programs is even more difficult to assess reliably with only two cases, one of which began with substantially higher levels of racial isolation than the other. The data indicate, however, that the district choosing voluntary comprehensive desegregation produced more rapid housing integration. In recent years, however, there has been a noticeable reversal in both school and housing segregation in this district.

This study makes three important contributions to our knowledge about the measurement and analysis of school desegregation effects. First, a detailed review of how to measure and assess the reliability of changes in racial and ethnic segregation advances the field by demonstrating that techniques developed over the past 25 years are ready to support unequivocal and reliable judgments regarding the meaning of school composition data. Second, this study demonstrates that, although school integration may have only a modest impact on students' educational opportunities and gaps in student achievement, there is good reason to believe that the desegregation effort has, over an extended period, been accompanied by substantial promotion of residentially integrated neighborhoods. It seems quite likely that we will find that social, political, and possibly educational benefits follow this integration of schools and neighborhoods. Third, this study demonstrates how to array school and census data in ways that can document the relative effectiveness of alternative desegregation strategies in producing the expected housing integration.

Author's Note

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References

Anyon, J. (1997). *Ghetto schooling: A political economy of urban educational reform*. New York: Teachers College Press.

Armor, D. J. (1995). *Forced justice: School desegregation and the law*. New York: Oxford University Press.

Blau, P. M. (1977). *Inequality and heterogeneity: A primitive theory of social structure*. New York: Free Press.

Brown v. Board of Education of Topeka (I), 347 U.S. 483 (1954).

Brown v. Board of Education of Topeka (II), 349 U.S. 294 (1955).

Brussat, W. K., & Riemer, S. (1951). The neighborhood as a function of school and childhood: A critique of the use of the elementary school as the focal point in neighborhood planning. *Journal of Educational Sociology, 25*(1), 5-15.

Clotfelter, C. T. (2004). *After Brown: The rise and retreat of school desegregation*. Princeton, NJ: Princeton University Press.

Cortese, C. F., Falk, R. F., & Cohen, J. C. (1976) Further considerations of the methodological analysis of segregation indices. *American Sociological Review, 41*(4), 630-637.

Crain, R. L., & Mahard, R. E. (1978). Desegregation and black achievement: A review of the research. *Law and Contemporary Problems, 42*(3), 17-56.

Cutler, W. W. (1989). Cathedral of culture: The schoolhouse in American educational thought and practice since 1820. *History of Education Quarterly, 29*(1), 1-40.

Dewey, R. (1950). The neighborhood, urban ecology, and city planners. *American Sociological Review, 15*, 502-507.

Douglas, D. M. (1997). The end of busing? *Michigan Law Review, 95*, 1715-1737.

Duncan, O. D., & Duncan, B. (1955). A methodological analysis of segregation indexes. *American Sociological Review, 20*, 210-217.

Feagin, J. R. (1999). Excluding blacks and others from housing: The foundation of White racism. *Cityscape, 4*(3), 79-91.

Frey, W. H. (2001, June). *Melting pot suburbs: A Census 2000 study of suburban diversity* (Census 2000 Series). Washington, DC: The Brookings Institution, Center on Urban & Metropolitan Policy.

Frey, W. H. (2002, February). *Metro magnets for minorities and Whites: Melting pots, the new sunbelt, and the heartland* (PSC Research Report No. 02-496). Ann Arbor: University of Michigan, Population Studies Center at the Institute for Social Research.

Gerckens, L. C. (1992). Milestones in American city planning: From the plan of Chicago to the crash. *Blueprints, 10*(2), 1, 5-7. Retrieved October 30, 2006, from http://www.nbm.org/blueprints/90s/spring92/contents/contents.htm

Grannis, R. (2005). T-communities: Pedestrian street networks and residential segregation in Chicago, Los Angeles, and New York. *City & Community, 4*, 295-321.

Hendrick, I. G. (1968). *The development of a school integration plan in Riverside, California, a history and perspective*. Riverside, CA: Riverside Unified School district and University of California.

Hochschild, J. L., & Scovronick, N. (2003). *The American dream and the public schools.* New York: Oxford University Press.

Iceland, J., & Steinmetz, E. (2003, July). *The effects of using census block groups instead of census tracts when examining residential housing patterns* (Housing Patterns Working Paper). Washington, DC: U.S. Census Bureau, Housing and Household Economic Statistics Division. Retrieved August 9, 2009, from http://www.census.gov/hhes/www/housing/housing_patterns/pdf/unit_of_analysis.pdf

Iceland, J., Weinberg, D. H., & Steinmetz, E. (2002). *Racial and ethnic residential segregation in the United States: 1980-2000* (U.S. Census Bureau, Series CENSR-3). Washington, DC: U.S. Government Printing Office.

Irvine, R. W., & Irvine, J. J. (1983). The impact of the desegregation process on the education of Black students: Key variables. *Journal of Negro Education, 52*, 410-422.

Kersten, K. A. (1995). *Good intentions are not enough: The peril posed by Minnesota's new desegregation plan*. Minneapolis, MN: Center of the American Experiment. (ERIC Document Reproduction Service No. ED383785).

Keyes v. School District No. 1, 413 U.S. 189 (1973).

Massey, D. S., & Denton, N. A. (1988). The dimension of racial segregation. *Social Forces, 67*, 281-315.

Massey, D. S., & Denton, N. A. (1993). *American apartheid: Segregation and the making of the underclass*. Cambridge, MA: Harvard University Press.

Moran, P. W. (2005). *Race, law, and the desegregation of public schools*. New York: LFP Scholarly Publishing.

Olzak, S., Shanahan, S., & West, E. (1994). School desegregation, interracial exposure, and antibusing activity in contemporary urban America. *American Journal of Sociology, 100*, 196-241.

Orfield, G., & Eaton, S. E. (1996). *Dismantling desegregation. The quiet reversal of* Brown v. Board of Education. New York: New Press.

Orfield, G., Gordon, N., & Civil Rights Project. (2001). *Schools more separate: Consequences of a decade of resegregation.* Cambridge, MA: The Civil Rights Project, Harvard University.

Pearce, D. (1980). *Breaking down barriers: New evidence on the impact of metropolitan school desegregation on housing patterns* (NIE-G-78-0125). Washington, DC: National Institute of Education.

Pielou, E. C. (1972). Niche width and niche overlap: A method for measuring them. *Ecology, 53*(4), 687-692.

Quinn, L. M., & Pawasarat, J. (2003, January). *Racial integration in urban America: A block level analysis of African American and White housing patterns*. Milwaukee, WI: Employment and Training Institute, School of Continuing Education, University of Wisconsin-Milwaukee. Retrieved August 9, 2009, from http://www4.uwm.edu/eti/integration/integration.pdf.

Reardon, S. F., & Firebaugh, G. (2002). Measures of multigroup segregation. *Sociological Methodology, 32*, 33-67.

Reardon, S. F., Yun, J. T., & Eitle, T. M. (2000). The changing structure of school segregation: Measurement and evidence of multiracial metropolitan-area school segregation, 1989-1995. *Demography, 37*, 351-364.

Rivkin, S. G. (2000). School desegregation, academic achievement, and earnings. *Journal of Human Resources, 35*, 333-346.

Rosenbaum, J. E. (1995). Changing the geography of opportunity by expanding residential choice: Lessons from the Gatreaux program. *Housing Policy Debate, 6*, 231-269.

Rossell, C. (1990). *The carrot or the stick for school desegregation policy: Magnet schools or forced busing*. Philadelphia: Temple University Press.

Rumberger, R. W., & Wilms, J. D. (1992). The impact of racial and ethnic segregation on the achievement gap in California high schools. *Educational Evaluation and Policy Analysis, 14*, 377-396.

Snyder, T. D., Tan, A. G., & Hoffman, C. M. (2006). Digest of education statistics 2005 (NCES 2006-030). Washington, DC: U.S. Government Printing Office. (Table 63 retrieved December 18, 2007, from http://nces.ed.gov/programs/digest/d05/tables/dt05_063. asp)

Swann v. Charlotte-Mecklenburg, 402 U.S. 91 (1971).

Theil, H. (1972). *Statistical decomposition analysis*. Amsterdam: North Holland.

Trent, W. T. (1997). Outcomes of school desegregation: Findings from longitudinal research. *Journal of Negro Education, 66*, 255-257.

Varady, D. P., & Raffel, J. A. (1993). Two approaches to school desegregation and their impacts on city–suburban choice: Cincinnati, Ohio, and Wilmington, Delaware. *Journal of Urban Affairs, 15*, 259-274.

Varady, D. P., & Raffel, J. A. (1995). *Selling cities: Attracting homebuyers through school and housing programs*. Albany: State University of New York Press.

Wells, A. S. (1995). Reexamining social science research in school desegregation: Long-versus short-term effects. *Teachers College Record, 96*, 691-706.

White, M. J. (1986). Segregation and diversity measures in population distribution. *Population Index, 52*(2), 198-221.

Yinger, J. (1998). Housing discrimination is still worth worrying about. *Housing Policy Debate, 9*, 893-927.

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