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The Emerging Spatial Organization of the Metropolis: Zones of Diversity and Minority Enclaves in Chicago

Wenquan Zhang and

University of Wisconsin, Whitewater

John R. Logan

Brown University

Abstract

The rapid growth of Asian and Hispanic populations in urban areas is superceding traditional classifications of neighborhoods (for example as white, transitional, or minority). The “global neighborhood” that includes all groups (white, black, Hispanic and Asian) is one important new category. We examine the emerging spatial pattern of racial/ethnic composition in the Chicago metropolis, documenting an expansion of all-minority neighborhoods in the city and just beyond its borders, a shrinking set of all-white neighborhoods in the outer suburbs, and more diverse neighborhoods including whites mainly in between. The most novel element of this pattern is how large the zone of diversity has become and how far it extends into suburbia, upending the old dichotomy of “chocolate city” and “vanilla suburbs.” In addition to comparing the distance of different kinds of neighborhoods from the urban core, we also analyze their adjacency to neighborhoods of the same type or other types. There is a strong tendency toward spatial clustering of each neighborhood type and also for transitions on the boundaries of clusters either to expand or to contract their territory.

The rapid growth of Asian and Hispanic populations in urban areas is superceding traditional classifications of neighborhoods (for example as white, transitional, or black). Decades of continual mass immigration are leading to significant revision of residential patterns including the disappearance of white neighborhoods and the emergence of various kinds of multiethnic communities (Lee and Wood 1991; Frey and Farley 1996; Denton and Massey 1991; Parisi, Lichter, and Taquino 2015). The “global neighborhood” is a prime example of a major new category that includes a significant presence of non-Hispanic whites and blacks along with newer Hispanic and Asian minorities (Logan and Zhang 2010; Zhang and Logan 2016). Studying the decade-by-decade pathways to the creation of these diverse communities, Logan and Zhang provide evidence for a now-common sequence of neighborhood change where an all-white neighborhood first accepts growing shares of Hispanic and/or Asian residents and subsequently is available for entry by African Americans. This scenario coexists with other pathways of change where persistence of ghettos, formation of new immigrant enclaves, and white flight limit the potential for reduced residential segregation.

Here we examine the spatial pattern of these changes in a major multiethnic metropolis, Chicago. The analysis has a dual purpose. One is to describe where these changes are occurring and how are they reshaping the familiar pattern in which minorities are highly concentrated in the urban core while whites increasingly withdraw to suburbia. This concern leads us to emphasize the question of location on the **center-periphery** dimension. The other is to determine what kinds of neighborhoods are clustered together and how clusters evolve over time. The spatial structure of change has implications for the role of spatial proximity and diffusion in contemporary neighborhood racial change. This interest leads to a focus on **adjacency**. Therefore alongside a simple mapping of types of neighborhoods based on their racial/ethnic composition, we will also assess measures of centralization and adjacency in this metropolitan region.

Although the pathways of neighborhood change in Chicago are also found to a greater or lesser degree in most metropolitan regions of the nation (as shown by Zhang and Logan 2016), we are not arguing that they have the same spatial pattern in other places. But the same questions apply elsewhere and the methodological approaches used here can be applied generally to reveal similarities and differences around the country. To facilitate such research, we make available maps and shapefiles for each decade 1980–2010 for the entire nation, based on the same categorizations of neighborhoods employed here, on our project website [*URL withheld to maintain anonymity*].

We begin with a review of relevant theories and previous findings on the spatial structure of diversity in the metropolis. We then describe our approach to categorizing census tracts by their racial/ethnic composition, compare it to an alternative conceptualization of the phenomenon based on levels of diversity, and define the summary measures of centralization and adjacency that we will employ. Finally we present findings for Chicago in 1980 and 2010.

Components of the spatial pattern: centrality and adjacency

A durable account of the spatial organization of the city was present in early conceptualizations of urban development. In Burgess's (1925) "concentric zone" model, urban space is divided into distance bands of distinct residential and other functions: the Central Business District (CBD) at the center, a zone of transition nearby serving lower income, immigrant, and minority groups, a working man's zone beyond it, and a commuter zone of more affluent families (white natives) in the outer most ring. This model is normally visualized at a single point in time, but more importantly it is a dynamic model. It is founded on the premise that the city grows by extension from the center, the CBD expands, impinging on the zone of transition that is displaced outward, while the commuter zone reaches ever further away from the center, creating room for the working man's zone to follow.

This spatial pattern has been interpreted in terms of three related processes of change. One is mainly demographic, a sequence of invasion and succession as whites abandon areas that are being settled by minorities and relocate further from the city center. Another refers to a life cycle or neighborhood aging process (Hoover and Vernon 1959) that helps account for

which neighborhoods will undergo change and when. For example, on the whole the older neighborhoods are closer to the CBD and more likely to have deteriorated enough to become unattractive for populations that have choices. The third account reflects the mobility of individuals or groups as expressed in spatial assimilation (Massey and Mullen 1984; Massey and Denton 1985). New arrivals are expected to be found in specific locational niches associated with their ethnicity and social class and then to experience upward mobility at some time in their lifetime or in the next generation. At that point they will find better housing opportunities in a different range of neighborhoods. All three processes are consistent with the concentric zones that Burgess laid out.

The boundary between city and suburb became a crucial feature of this spatial pattern as a result of post-World War II suburbanization. Evidence for spatial assimilation is found in studies showing that minorities (especially newcomer groups like blacks from the South, Puerto Ricans, and immigrants) tend to locate in the central city core area, while neighborhoods become progressively whiter in suburbia (Duncan and Duncan 1957; Taeuber and Taeuber 1959; Massey and Denton 1993). Expressions of “Chocolate city” and “Vanilla suburbs” (Farley et al. 1978) vividly capture these contrasting racial/ethnic formations. In general, suburban residents tend to be more affluent, better educated, and (among immigrants) have greater length of stay in this country than their central city counterparts (Farley 1970; Guest 1978).

Burgess identified inner city sectors that housed first generation immigrants such as Italians and Jews in addition to the growing African American population. He perceived earlier immigrant groups like Irish and Germans as having already more or less assimilated into locations appropriate to their class position farther from the CBD, so he defined these outer zones in terms of cost, density, and access to employment rather than by ethnicity. By the 1960s, however, the dichotomy of white vs. black was the main categorization, and most ecological studies identified a spatial pattern of older, mainly black and poor inner city neighborhoods, other zones within the city that included a mix of largely second-generation European immigrants and native whites with working class to middle class standing, and suburbs that were largely thought of as white and middle class. Of course there were important exceptions to this generalization, such as affluent enclaves near the CBD and older “industrial satellites” (Schnore 1964; Logan 1976) in the suburban zone.

In this mid-20th Century era neighborhood racial change was studied as a unidirectional transformation from white to black through processes described as invasion and succession. Black “invasion” would be followed by continued racial change, leading finally to a predominantly black composition (Duncan and Duncan 1957; Taeuber and Taeuber 1965). Many white neighborhoods, it was recognized, remained resistant to black invasion, but once begun (or at least once a given “tipping point” was reached) the process was nearly certain to result in “succession.” In spatial terms it was expected for existing black neighborhoods to grow by expansion into adjacent formerly white areas, while whites moved increasingly outward, beyond the city limits, and into the suburbs. In between the largely black and largely white areas would be temporary and ever-moving zones of transition. Black population eventually began to spill over into the inner suburbs, typically the communities that had been developed much earlier and now were beginning to experience the problems of

aging housing stock and disinvestment (Schneider and Logan 1982; Logan and Schneider 1984; Hall and Lee 2010).

In the contemporary period there are new large immigrant population groups to take into account, mirroring the complexity of the “metropolitan mosaic” early in the 20th Century. To some extent they have replicated the previous immigrant pattern of establishing residential enclaves in cities (Logan, Alba, and Zhang 2002; Lichter et al. 2010; Alba et al. 2014). They have also moved directly into suburban areas (Alba and Logan 1991; Farrell 2016). In the global neighborhoods narrative, they have become an important presence in zones left behind by whites, especially in the form of newly Hispanic or black/Hispanic neighborhoods. In other parts of the metropolis they are leading a process of integration of previously all-white communities.

This brief account of the changing spatial structure of the metropolis leads to expectations about recent trends. The main aspects of the traditional concentric zone model seem to persist. We expect to find all-minority neighborhoods mainly in the central city, expanding over time and possibly reaching into the inner suburbs. All-white neighborhoods, at the other extreme, can be expected mostly in the middle and outer suburbs. If they are contracting, as has been reported, they may be clustering on the outer edge of the metropolis. More diverse neighborhoods including whites would be found somewhere in between, in the city or in the suburbs or both. It is the location of these more diverse neighborhoods that seems less sure. We suggest three plausible scenarios:

- One rests on the historical invasion-succession model. If diversity were still transitional, diverse neighborhoods might be found around the boundaries of minority areas, in locations that were once largely white but are experiencing white flight. Diverse neighborhoods would be found as extensions from minority zones, but they would be transitory.
- A second scenario is based on the recent gentrification literature. If there has been a return of predominantly white and middle class households to desirable areas in the central city, this process would create a different type of transitional zone, possibly near the CBD, as new pockets within or near largely minority areas. Such revanchist gentrification is posited by Smith (1996) and many more recent studies (Lees 2008, among others). Whites might be joined by Asians, Hispanics, and blacks with similar backgrounds in diverse inner city neighborhoods.
- Another possibility is based on the reported findings on pathways of neighborhood change toward global neighborhoods. According to Logan and Zhang (2010), diversity is rarely due to white return to minority neighborhoods and more often a result of Hispanic and Asian entry into white neighborhoods, later followed by African Americans. In that case we might expect diverse neighborhoods to leapfrog to previously white areas in the midst of suburbia. This alternative is further supported by another finding, that global neighborhoods tend to be relatively affluent, therefore neither in the inner ring suburbs that whites are leaving nor in the inner city. The literature on

“ethnoburbs” with large Asian minorities (Li 1998; Zhou 2010; Zhou and Logan 1989; Zhou, Tseng, and Kim 2008) illustrates such a pattern.

These alternative scenarios leave open multiple possibilities for the location of different kinds of neighborhood transitions on a center-periphery dimension. However they all start from a similar initial pattern based on the historic invasion-succession model of racial change, according to which in 1980 we would expect a clear concentric zone pattern of minority concentration in the city, white areas on the edge of the metropolis, and various kinds of mixes in between.

Another common assumption is that there will be clear patterns of spatial clustering of similar neighborhoods and adjacency to certain other neighborhood types. The most likely neighbor of a given kind of tract is one of the same type. One source of clustering could be a tendency for a certain type of racial/ethnic mixture to grow over time by expanding at the edges of an existing area of that type rather than popping up in a very different location. Such clustering could be attributable to what is called a spatial lag, where the characteristics of one tract have an effect on the changes occurring in a neighbor. Or it could be due to other features that neighboring tracts have in common that influence the direction of racial/ethnic change in all of them.

Research Design

We study a single multi-ethnic metropolitan region, Chicago (the Chicago-Joliet-Naperville metropolitan division). The analysis relies heavily on visualization of spatial patterns, comparing maps in 1980 and 2010 (which is the period studied on a national scale by Zhang and Logan 2016). Similar analyses could be completed for any metropolitan area, and we presume that these could reveal important differences. Our purpose here is exploratory, framing questions about the spatial pattern and offering an approach to examining them.

The analysis relies on the following steps. First, we classify neighborhoods (census tracts) according to their racial composition in both 1980 and 2010. Second, we examine a transition matrix to evaluate persistence and change in composition over time. Finally we use GIS tools to compute spatial statistics and create a series of choropleth maps to determine the locations of different kinds of neighborhoods in 1980 and show where transitions occurred over time.

Chicago has been described as the *Great American City* (Sampson 2012), and it is well known as a site for research on minority/majority relations, immigrant adaptation, and residential segregation. With its well-established central city and the surrounding suburban areas and beyond, Chicago has some of the geographic features of a typical American city. It is distinctive mainly in the concentration of its large black population in two large zones on the South Side and West Side of the city, a pattern that emerged as early as the late 19th Century (Logan, Zhang, and Chunyu 2015). The substantial increase of Hispanic and Asian populations in Chicago in recent decades (more than in most of the Midwest) has transformed it into a true multiethnic metropolis with significant presence of all major racial and ethnic groups. Table 1 provides evidence of this growing diversity. The total population in the metro area saw an increase of about 1 million over three decades. The share of non-

Hispanic white dropped from 68.4% to 52.1% (or an absolute reduction of about half a million). The share of non-Hispanic black was slightly reduced. In a sharp contrast, both Hispanics and Asians reported significant increase in both absolute numbers and relative share. Hispanic population more than doubled to raise their population share by 13.4 percentage points and thus surpassed blacks to become the biggest minority group. The Asian population nearly quadrupled to account for 6.7% of total population in 2010.

Measuring neighborhood diversity

We apply a categorization of neighborhood types developed in the global neighborhood literature.¹ This scheme is limited to the four largest racial-ethnic groups identified by the census: non-Hispanic whites (W), non-Hispanic blacks (B), Hispanics (H), and Asians (A). It omits other races (e.g., Native Americans and Pacific Islanders) that are not found in large numbers in metropolitan areas. More significantly it does not consider the substantial differences in background, culture, and class position among Hispanics and Asians from different national origins (Logan et al. 2002). These are the same broad group categories studied by Zhang and Logan (2016), and we apply their definition of group presence in a census tract: at least a quarter of the average group share in metro areas across the country. In 1980 we count non-Hispanic whites as present if their share is at least 15.8% of the tract total, blacks at least 4.7%, Hispanics at least 3.6%, and Asians at least 0.7%. In 2010, reflecting the relative decline of white population and growth of Hispanics and Asians, these cutoff points are changed to 10.5%, 4.5%, 7.4% and 2.4%. We apply these definitions to tracts that have been harmonized to 2010 tract boundaries using estimates provided in the Longitudinal Tract Data Base or LTDB (Logan, Xu, and Stults 2014, <https://s4.ad.brown.edu/projects/diversity/Researcher/Bridging.htm>). Any changes in composition, therefore, cannot be attributed to boundary shifts.

With four groups there are potentially 15 possible combinations. (Here we use abbreviations to denote which groups are present in a tract: W, B, H, and A.) Some of these – all-minority tracts where Asians are present – are very rare in Chicago. Therefore in our first phase of analysis we combine four categories (A, HA, BA, and BHA) into a single one (NW-A, standing for non-white with Asians present). This simplification leaves twelve categories. There are four combinations of non-white (or all minority) neighborhoods: B, H, BH, and NW-A. W represents all-white neighborhoods. WA, WH, and WHA are areas shared by whites and immigrants without blacks. WB neighborhoods are composed only of whites and blacks. WBA and WBH are two versions of neighborhoods where whites, blacks, and either Asians or Hispanics are present, similar to a global neighborhood. WBHA denotes the global neighborhood, where all four groups are significantly present.

¹Other researchers have experimented with alternative classifications. Wright et al. (2014) classify tracts using three levels of “diversity” (measured with an entropy index) and the identity of the largest racial/ethnic group to create 13 categories. Holloway, Wright and Ellis (2012) reduce these to one category of “highly diverse” tracts, plus four categories of “moderate diversity” tracts and four more categories of “low diversity” tracts defined by their largest racial/ethnic group. Other schemes are implemented by scholars like Ellen, Horn, and O’Regan (2012), Friedman (2008), and Fasenfast, Booza, and Metzger (2006). Regardless of the classification scheme, these studies converge in demonstrating the co-existence of both increasing racial diversity and persistent racial segregation in many metropolitan areas. The principal advantage of our approach is that it explicitly defines which groups are found together in a tract and how that composition changes over time.

The definitions of neighborhood types may seem somewhat arbitrary. Further there could be advantages in a study of a single metropolitan region to tailoring the categories to the overall composition of that area (so that, for example, if an area has much more than the average share of Hispanic or Asian residents, the criterion for Hispanic or Asian presence would be higher). The disadvantage is that doing so could result in very dissimilar definitions in various parts of the country. Zhang and Logan (2016) dealt with this issue by using a single national standard but making comparisons only among regions with similar composition. In this case, the national criteria result in categories that on average well represent the intended typology. Appendix Table 1 shows the actual average composition of different types of Chicago neighborhoods in 1980 and 2010. On average, global neighborhoods are the most diverse. In 2010 they retained a majority (53.2%) of white residents, and large shares of blacks (12.7%), Hispanics (22.0%), and Asians (11.4%). All-white neighborhoods were 92.1% white; black neighborhoods were 96.0% black. Chicago's profile is very similar to other large multiethnic metropolises.

Others have studied the mixing of racial/ethnic group at the neighborhood level without imposing categories like these, calculating and analyzing changes in a single measure of intra-tract diversity. The measure is a local entropy index (E_i), which can be calculated for either a single tract or for a larger place or metropolitan region (Lee, Iceland, and Farrell 2014). The entropy index attains its maximum value when all groups in a tract are present in the same numbers (in a four-group study, each would be 25% of the total). One disadvantage of the measure is that smaller groups, such as Asians, are rarely present at that level, while large groups (like whites in a typical urban area) are greatly under-represented at only 25%. For our study, a greater disadvantage is that there are many combinations of group representation that yield the same diversity score, so that knowing the level of diversity or direction of change provides only limited information about what groups are present.

We illustrate this characteristic in Figure 1, which plots the distribution of entropy scores across categories of racial composition in Chicago in 1980 and 2010. These plots show the median, the first and the third quartile, as well as the maximum and minimum Entropy values for each type of neighborhood over time. The width of the box reflects the number of tracts of a given category in 1980 or 2010. The weighted average entropy score across all tracts in Chicago increased markedly, from .37 to .72. As expected, the single-group categories (white, black, or Hispanic only) have the lowest average scores in both years. Global neighborhoods (WBHA) and those with whites and two other groups have the highest average scores. However the figure demonstrates that knowledge of the entropy score does not offer much further information about who is represented in the tract. On average an all-minority tract has about the same "diversity" in 1980 as a black-Hispanic tract, or a white-black or white-black-Asian tract. Yet in terms of our substantive concerns about segregation, the absence of whites has particular meaning for past white flight or white aversion to entry, and the combination of blacks with whites is an entirely different phenomenon than the combination of blacks with Hispanics. Further, there is much variation around the mean *within* all the neighborhood categories. This means that if entropy increases or declines in a given tract, one doesn't know if the change was due to increase or decline in already present groups or entry of a new group. By identifying the largest racial/ethnic group in a tract along with the entropy index, the scheme used by Holloway, Wright and Ellis

(2012) is more explicit, but by not identifying the second or third other group, it still treats some substantively different combinations (e.g., whites with Asians and whites with blacks) as though they were equivalent. Our purpose is not to study “diversity” in itself, but rather to understand how different racial/ethnic groups locate and relocate in relation to one another.

Measuring centralization and adjacency

For every type of tract we wish to calculate summary measures of their location in the metropolis (in relation to the central core) and their adjacency to other tracts of the same type or different types. “Distance” is measured by the linear distance of the tract from Chicago’s downtown Loop. A standard index of spatial clustering is the global Moran’s I statistic (Moran 1950). It measures the extent to which a tract with a high share of a given group is located near other tracts with high shares, and conversely tracts with low shares are also found near one another. Moran’s I can vary from -1 (similar tracts are decidedly not adjacent) to $+1$ (similar tracts have a very high probability of being located adjacent to one another in a spatial cluster). If we define neighbors with a row-standardized 1st-order rook spatial weight matrix (neighboring tracts share a boundary), we find a very strong spatial patterning of racial/ethnic groups in Chicago in 2010: .877 for white percent, .859 for black percent, .798 for Hispanic percent, and .708 for Asian percent.

There is not a similar measure for the clustering of categories of neighborhoods such as we have defined here. A simple substitute is to count the frequency of isolated outliers – that is, tracts of a given type that are *entirely surrounded* by tracts of a different type. A smaller share of outliers suggests a higher degree of clustering of that neighborhood type. Measured in this way, less than 10% of tracts in the Chicago metropolis in 1980 or 2010 were isolated outliers by this definition. Our approach to measuring adjacency is somewhat similar to this, but it identifies specifically which type of neighborhood is more likely to be adjacent.

We explain our measure by using BH (black-Hispanic) tracts as an example. We begin by counting all the neighbors of BH tracts of in the region and their distribution among all twelve types of tracts (including BH). The result is one row in a twelve-by-twelve “adjacency matrix.” A defect of this matrix is that relatively rare types are unlikely to be neighbors while more common ones are more likely. Therefore we standardize the values to odds ratios. For example, the odds ratio of adjacency of a BH tract to another BH tract is the odds that any BH tract is adjacent to another BH tract divided by the odds that a non-BH tract is adjacent to a BH tract. An odds ratio of greater than 1.0 indicates that a particular pairing is more likely than expected, less than 1.0 indicates less than likely.

Results

We begin by reviewing the transitions that occurred in tract composition between 1980 and 2010. This tabulation takes the form of a 12×12 transition matrix, displayed in Table 2. The row headers represent the neighborhood categories in 1980, and the column headers represent the neighborhood categories in 2010. The cells along the main diagonal represent tracts that remained in the same neighborhood category after three decades. More than half (57.9%) of tracts changed categories. Some transitions are particularly notable.

There is a dramatic shrinkage in all-white tracts. Only a quarter of the 287 all-white tracts remain in that category in 2010. The predominant change was to add Hispanics, Asians, or both. However a moderate number also transitioned directly to global neighborhoods (28) or neighborhoods with white, blacks, and Hispanics. In only 9 cases did white tracts become white and black.

Global neighborhoods (WBHA) grew substantially from 134 in 1980 to 333 in 2010. The origin of new global neighborhoods was most often a neighborhood that already included whites along with Hispanics and/or Asians. These accounted for 194 of the new WBHA cases, consistent with the view that new immigrant groups somehow facilitate the entry of blacks into formerly white neighborhoods. Similarly, a moderate number of initially WH or WA tracts added black populations by 2010, resulting in an increase in the number of “almost” global neighborhoods, either WBH or WBA.

One other kind of transition is common: white neighborhoods that added Hispanics and/or Asians, increasing diversity without yet including a black presence. These transitions most often involved Hispanics. Over 100 white tracts become WH or WHA by 2010, and an equal number of white-Asian tracts added Hispanics, becoming WHA. These shifts may create a future possibility for black entry, following the pattern established in 1980–2010.

There is a counterpoint to these trends toward greater diversity. The number of tracts without a white presence also increased. There was only a slight growth in the number of all-black tracts; most black tracts simply remained black. The larger share of these changes involved growth in Hispanic (H) or black and Hispanic (BH) neighborhoods, which together rose from only 38 in 1980 to 152 in 2010. In most of these cases the change resulted from white flight, sometimes also including a loss of Asian presence. As previously pointed out by Logan and Zhang (2010) and Wright et al. (2014), there remains a potent aversion of whites to living with black and Hispanic minorities even in this era of increasing neighborhood diversity.

Spatial Dependence and Distance to the City

Now we ask what is the spatial pattern of these neighborhoods and their transitions? Table 3 addresses the degree of centralization of each type of tract in 1980 and 2010. The average tract is 18.3 miles from the center. But this average varies greatly among types of neighborhoods in a way that seems consistent with the concentric zone model. White neighborhoods averaged 29.1 miles from the center in 1980, and those that remained white (only about a quarter of the originals) averaged even farther away (35.1 miles) in 2010. In contrast, the all-minority neighborhood types were consistently near the city center. In 2010, the means were 4.4 for non-white neighborhoods including Asians (NW-A), 5.4 miles for Hispanic tracts, 7.8 miles for black tracts, and 10.0 miles for black-Hispanic tracts. All of these values are small enough to remain within the city boundaries.

In between lie all the more diverse types of tracts where white residents continue to live alongside some combination of other groups. In the traditional concentric zone model these would be interpreted as transitional and likely to experience white flight. In the

contemporary global neighborhoods model, however, the global neighborhood is among the most stable over time, and we might expect to see this particular zone of diversity expanding over time into new areas.

Figure 2 shows the distribution of the distance of each type of tract more completely in the form of box plots. Each plot reports the median distance and the distances at the 25th and 75th percentiles, plus the maximum and minimum distances. The width of the box is in proportion to the number of tracts of a given type in 1980 or 2010. The figure allows us to visualize the degree of variation within each type of neighborhood as well as the extent of change over time. With few exceptions, the non-white types of neighborhoods are tightly confined within the city boundary, and the very tight inter-quartile range suggests a relatively low degree of variation among these neighborhoods. At the other extreme, the all-white areas are the furthest from city of all neighborhoods but with a wide inter-quartile gap. Over time, this category shrinks significantly and the remaining neighborhoods report an outwardly extension, partly due to the gradual diversification thus disappearance of the all-white neighborhoods found in the immediate suburbs at the beginning of the period. Mixed neighborhoods are located mostly in between the inner minority core and the all-white periphery throughout the period. Most of these categories, including the global neighborhoods, expand outwardly away from the city as times progress, with the exceptions of WB and WBA neighborhoods, which appear to be closer to the city in 2010 than 1980.

We now turn to patterns of adjacency. Table 4a and 4b show the odds-ratio of a tract that is adjacent to a neighborhood of the same type in 1980 and 2010, respectively. The rows mark the main types of neighborhoods and the columns indicate the different types of neighborhoods among their 10 nearest neighbors.² Take the example of WBHA in 1980. The odds-ratio of 23.5 is calculated as the odds of global neighborhoods having global neighborhood among their neighbors (10 nearest tracts) over the odds of non-global neighborhoods having global neighborhood neighbors.

Patterns of adjacency show clearly that the same type attracts. The main diagonal cells have much higher odds-ratio than other cells. The H and B areas particularly stand out in this regard. W, WA, WHA, WB, WBA, and global neighborhoods are all highly associated with the same type neighbors. To a less degree, BH and WH tracts are also clustered. The non-white tracts, in the upper left corner of the table, report high adjacency to other non-white tracts. In particular, neighborhoods of Hispanic dominance (H) are most likely found next to NW-A and BH neighborhoods, but noticeably not with black-only neighborhoods. Few other cells report positive association above the expectation level. For example, certain mixed neighborhoods tend to be close to the non-white areas, such as WH with H and BH, or the WBH with BH.

This basic structure remains after three decades with changes mainly in the magnitudes of the measures. By 2010, the extreme isolation of non-white tracts worsened except for the H neighborhoods. The isolation (i.e., the odds ratio of adjacency with like tracts) for W and

²We have tried out other standards of adjacency, such as first order or second order contiguity, and from five to forty-two nearest neighbors. The patterns of the findings remain, though the magnitudes of the odds-ratio change.

WB tracts also increased. Meanwhile, some other mixed neighborhoods, especially the global neighborhoods, reported lower odds-ratios over time as they spread more widely around the region. Moreover, the odds of white-present tracts to have non-white neighbors were further reduced over time, alluding to the fact that while diverse areas had been moving away from the city, the non-white areas tended to stay put. These results are consistent with the observed general pattern of expanding diversity, shrinking all-white areas, and the persistently isolated minority ghettos.

Mapping neighborhood change

The information presented up to now provides some guidance for our interpretation of the maps of neighborhood change. We have described a typology of neighborhoods, and then shown how tracts are distributed among types, their increase or decline in number, the specific kinds of transitions that are most common, the spatial clustering of neighborhood types, and their location along a center-periphery dimension. Now we present a series of maps highlighting the 1980 spatial pattern and the changes that occurred by 2010.

Dramatic changes to the mosaic

We begin with a diptych of the maps showing major neighborhood types in both years (Figure 3). To simplify this complex map, we reduce the number of categories from twelve to seven (WH and WA are combined into W+H/A, WBH and WBA are combined into WB+H/A, and all non-white neighborhoods into NW). Consider first the 1980 pattern. Notice that there is a strong spatial pattern, in the sense that tracts of the same color tend very much to appear in large clusters. The pattern resembles the concentric zone model of white periphery, minority center, and mixed areas in between. Note first the large share of the total areas that is light blue, representing all-white tracts. These line the southern, western, and northwestern edges of the metropolitan region, stacked together two or more layers deep from the outer metro boundary. In contrast most of the red tracts, representing various combination of all-minority tracts, are within the center city, including the well-known black belt on the South Side and also West Side of the city. The South Side minority zone extends southward across the city boundary to a set of tracts that include both whites and blacks, those with Hispanics and/or Asians in addition are shown in yellow, and those with neither immigrant minority in dark brown. Much of the remainder of the city is dark green, representing mixed WHA tracts where blacks are omitted. And lying mainly in between the city and the far periphery are other areas where whites are mixed with Hispanics, Asians, or both but rarely including blacks.

There are dramatic changes by 2010. As shown in the right-hand panel the metro in 2010 has a much smaller light-blue area, larger red area, and more and larger orange areas. These represent three main directions of transition: a major contraction of all-white areas, clear enlargement of all-minority areas, and a substantial expansion of global neighborhoods. Closer inspection reveals also a moderate expansion of the yellow area (where whites and blacks share neighborhoods with Hispanics or Asians but not both, which we have referred to as “almost” global neighborhoods).

Growth by expansion, decline by contraction

Another salient feature of the spatial pattern is that growth took place largely by expansion of existing clusters of similar neighborhood types to encompass a larger area, like ripples in a pond. This phenomenon is evident in the growth of all-minority areas within the city, where once separate South Side and East Side zones appear to have merged together, and the South Side all-minority area spilled over into the suburbs to the south of the city. It is as though the close proximity to an all-minority area had a causal impact on the trajectory of adjacent tracts, which is a common phenomenon cited in the invasion-succession literature. Another example is the emergence of new global neighborhoods (in orange). These existed in 1980 as several small clusters, mostly in the middle suburbs but also in the city north of the Loop. The much larger clusters of global neighborhoods in 2010 encompass these original ones.

Conversely the disappearance of all-white neighborhoods mostly took place as a contraction toward the outer edge of the metro area, which could be described as a retreat in the face of advancement of other more diverse neighborhood types.

Persistent black zones with expansion by Hispanics

Figure 4 provides a more detailed look at neighborhood types that were combined into the all-minority (red) type in Figure 3, enlarging the central city zone where these tracts were mostly found. Only the black, Hispanic, black-Hispanic, and NW-A (non-white with Asians) categories are displayed here. In 1980 most of the minority zone was comprised of black tracts, and other combinations were located around the edges of the black neighborhoods. Almost all the subsequent expansion within the city, and part of the expansion in the inner suburbs, was the result of Hispanic in-movement. Large new clusters of Hispanic tracts appeared near existing black tracts, and the small mixed black-Hispanic cluster on the southern border of the West Side neighborhood filled the gap between the West Side and South Side. In the center of that new minority area, furthest from the original black zone, Asians were included in the population mix.

It is interesting to notice that the new Hispanic tracts rarely were directly adjacent to black tracts. Instead, there were almost always mixed black-Hispanic (BH) tracts in between. The BH tracts recorded the biggest increase from 26 tracts in 1980 to 109 in 2010. These neighborhoods of significant presence of both blacks and Hispanics are immediately wrapping around the existing black clusters; they grew along the edges of the existing ghettos, and seemed to be a transition area between black and Hispanic neighborhoods.

Peripheral white areas

Figure 5 displays the all-white tracts in 1980 and shows how they had changed by 2010. The left panel shows nearly 300 all-white tracts in 1980, covering a large area on the metropolitan periphery and on either side of the Chicago city line. By 2010 only a fraction of these (one in five) remained all-white. Those near the city line have disappeared completely and the once large blocks of white tracts at the periphery have shrunk toward the metro boundary. Among the changed tracts, more than 2/3 (148) added Hispanics or Asians or both (shown in pink). In contrast only 9 added blacks to become WB (shown in dark

purple). Clearly the largely immigrant groups were the initial minority entrants into white areas.

In addition, 65 tracts (shown in green) added both blacks plus Hispanic and/or Asians. Upon closer look at the neighborhood type in the intervening years (not shown here) we see that many of them gained immigrant presence before black presence. This is a main source of creation of global neighborhoods. Lastly, seven once all-white tracts at the city boundary (shown in red) became non-white.

Diverse neighborhoods with immigrant minorities

Finally we call attention to the location of more diverse neighborhoods, where whites are settled along with Hispanics and/or Asians (WA, WH, WHA) and possibly also blacks (WBHA). Our main purpose here is to illustrate how global neighborhoods typically are created from areas that originally mixed whites with one of the largely immigrant minority groups.

In 1980, there were 487 tracts classified as WA (blue), which covered the vast area in the heart of the metro region, including a small area inside the northwest corner of the city. This large zone reflects the fact that in Chicago, as in most metropolitan regions, Asians have been less segregated from whites than either Hispanics or blacks. In the midst of this zone were clusters of WHA tracts (shown in green). WA and WHA tracts were found inside the city (on its northern end) and in the suburbs. (There was also a cluster of WH tracts in the northwest corner (largely rural McHenry County). In contrast, there were few global neighborhoods (WBHA) in 1980, some clustering along the shoreline north of the Loop and some in the suburbs. Most of these global neighborhoods were next to neighborhoods shared by whites and one or two immigrant groups.

The map looks very different in 2010. The WA areas shrank significantly from 487 to 264, and many of them added Hispanic presence to become WHA (114) or added both Hispanics and blacks to become global neighborhoods (110). The number of global neighborhoods in the metro rose from 134 to 333. The majority of the new ones were already shared by whites and immigrants, and as noted above they developed near the initial global neighborhood locations.

Discussion and Conclusion

We began with the premise that the trajectories of neighborhood change that created and reproduced black ghettos in the U.S. in the first half of the 20th Century have been altered as a result of the population growth of Hispanic and Asian minorities. Our goal has been to explore how this trend is affecting the spatial pattern of racial/ethnic groups in Chicago, as one example of a locale where these changes are taking place. Specifically we asked if this new phenomenon has disrupted the well-known concentric zone model, which understood the central city and inner suburbs as the main location of minorities and immigrants while whites and natives moved inexorably toward the metropolitan periphery. We posited two possible alternatives. One is based on gentrification of minority areas within the central city, pioneered by whites and potentially in combination with more economically successful

minority residents. The other is based on the documented trajectory of global neighborhoods, where white neighborhoods – more likely in the suburbs than in the city – are entered by Asians and Hispanics and then finally also to African Americans.

In the case of Chicago we found little evidence of white return to the city through gentrification. A considerable area of the city included whites in 1980, mostly in combination with Hispanics or Asians along with some all-white neighborhoods at the city limits and some global neighborhoods along the shoreline north of the CBD. The white neighborhoods all became more diverse by 2010, and the zone of global neighborhoods expanded into areas that previously had not had a black presence. But only a few tracts that did not already have a white presence in 1980 had gained one by 2010. Thirty tracts were nonwhite in 1980 but gained white presence. They are located in places like Ukrainian Village, West Town, Logan Square, and Greek Village, visible areas of gentrification in Chicago. Some of these places have since become the most desired residential neighborhoods in the city. They may represent an unstable form of diversity because they involve much dismantling of existing housing structures and removal of old residents. Yet although this phenomenon can be found, it is much smaller in scale and impact than other changes discovered here.

In contrast there is much evidence of the emergence of more global neighborhoods, a few in the city as just noted but mainly in the suburbs, and more often in the middle and outer suburbs than near the city line. Some all-white neighborhoods at the metropolitan periphery experienced this transition, but mainly it occurred in neighborhoods that already housed a mixture of whites, Hispanics and Asians. Hence global neighborhoods tended to leapfrog the inner suburbs to create greater diversity at farther distances from the CBD. Even so, the concentric zone model retains much descriptive power. The major dichotomy between all-minority and other neighborhoods is still defined by the city-suburb boundary. All-white neighborhoods are even more clearly aligned with the outer edge of the metropolis in 2010 than they were in 1980. More diverse areas still fall in between.

One major change in the spatial pattern has been the creation of new kinds of diversity. These mixtures are now found to be enduring rather than temporary. Suburbia is now more complex, with a new important distinction between diverse neighborhoods that do or do not include African Americans. There is no obvious relation between these types and distance from the city. Yet we also notice a meaningful continuity in the spatiality of neighborhood change. Tracts of every neighborhood type remain highly clustered with similar tracts, and changes take place mainly around the fringes of these clusters, either as contractions (in the case of white neighborhoods) or expansions (as seen most clearly with minority areas or global neighborhood areas). The sequence of invasion and succession no longer characterizes most neighborhood changes in Chicago. Even around the growing all-minority zone within the city, on the edges of established black neighborhoods what we find is not blacks but rather a new group – Hispanics -- replacing whites. But the ecologists' insight that ethnic neighborhoods consist of a relatively stable core area with transitions located around their edges seems still to hold.

Our findings on centralization and adjacency suggest a direction for future research, which could seek to measure the effects of both distance from the center and relations between adjacent neighborhoods. Such analyses were incorporated in Logan and Zhang's (2010) study of multiethnic metropolitan areas. Their approach was to select specific types of neighborhoods in 1980 that are theoretically interesting (WHA tracts that had potential to transition to global neighborhoods, global neighborhoods that had potential to lose white presence, and white tracts that might become more diverse), and use multinomial logit models to predict their type in 2010. Predictors included central city vs. suburban location and adjacency to other tract types. It would be desirable to analyze the full set of transitions taking into account distance and adjacency measures. One potential approach has been suggested by Rey (2001), in what he describes as a "spatial Markov" model. He applies the model to transitions of states between income categories that can be arranged from lower to higher income, taking into account the income categories (and changes in income) of neighboring states.

We suspect that some of the findings for Chicago will be replicated in other comparable multi-ethnic metropolitan regions that have experienced similar demographic transformations in the same period. Zhang and Logan (2016) point out that there is much variation in the composition of metropolitan regions around the country, although most are sharing in the relative decline of white population and rapid Hispanic and Asian growth. Also, to a greater or lesser extent, they are undergoing similar patterns of decline in all-white neighborhoods and increases in the numbers of both more diverse and all-minority neighborhoods. Still, the initial 1980 spatial pattern may differ in different parts of the country, and some differences from multi-ethnic regions have been shown in the neighborhood transitions occurring in metro areas that are disproportionately white or white and black, in contrast to those with more Hispanic and Asians and a smaller black presence.

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Appendix

Appendix Table 1

Average neighborhood group composition in Chicago, 1980 and 2010

	White		Black		Hispanic		Asian	
	1980	2010	1980	2010	1980	2010	1980	2010
NW-A	8.4	7.1	67.6	20.8	21.4	55.2	1.8	16.6
H	11.0	5.7	1.1	2.1	87.0	91.4	0.3	0.6
B	1.5	1.5	97.2	96.0	0.9	2.0	0.1	0.2
BH	8.7	4.5	63.1	44.9	27.4	49.8	0.2	0.5
W	97.3	92.1	0.3	1.1	1.7	5.0	0.4	1.4
WA	94.4	83.8	0.8	1.7	1.8	4.8	2.6	9.3
WH	76.6	53.5	0.8	2.0	21.7	42.7	0.4	1.3

	White		Black		Hispanic		Asian	
	1980	2010	1980	2010	1980	2010	1980	2010
WHA	77.1	64.4	1.0	2.3	16.8	23.9	4.0	8.9
WB	68.7	36.2	28.1	57.4	2.3	4.9	0.4	1.1
WBA	74.9	64.6	17.5	16.4	2.3	5.5	4.5	12.9
WBH	46.7	39.7	25.9	24.0	26.2	34.8	0.3	1.2
WBHA	62.8	53.2	16.6	12.7	13.5	22.0	5.4	11.4

Figure 1.
Entropy scores by neighborhood type, 1980 and 2010

Figure 2.
Distance from urban center in 1980 and 2010

Figure 3.
All neighborhoods

Figure 4.
Non-white neighborhoods

Figure 5.
White neighborhood transitions (1980 all-white neighborhoods)

Figure 6.
Diverse neighborhoods with immigrant minorities

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Table 1

Group composition in Chicago metro division, 1980 and 2010

	Total	White	Black	Hispanic	Asian
1980	66,87,984	68.4%	20.6%	8.4%	2.0%
2010	77,27,924	52.1%	18.9%	21.8%	6.7%

Table 2

Observed neighborhood transition matrix for Chicago metro division, 1980–2010

					TRACT CATEGORY IN 2010										
CATEGORY IN 1980	NW-A	H	B	BH	W	WA	WH	WHA	WB	WBA	WBH	WBHA	TOTAL		
NW-A	2	0	7	5	0	0	0	0	0	5	2	2	23		
H	0	7	0	1	0	0	1	1	0	0	1	1	12		
B	2	0	208	12	0	0	0	0	1	9	0	2	234		
BH	0	0	7	14	0	1	0	0	0	0	0	4	26		
W	0	1	4	2	58	34	55	59	9	2	35	28	287		
WA	0	0	2	0	11	179	12	114	7	43	9	110	487		
WH	4	23	1	19	2	1	27	23	0	0	27	9	136		
WHA	5	11	3	25	0	26	17	141	1	0	10	75	314		
WB	0	0	4	1	0	0	1	0	15	1	17	3	42		
WBA	3	0	3	1	1	2	0	0	10	30	9	13	72		
WBH	1	1	3	19	0	0	1	2	0	2	20	9	58		
WBHA	0	0	2	10	0	21	0	6	0	11	7	77	134		
TOTAL	17	43	244	109	72	264	114	346	43	103	137	333	1,825		

Table 3

Average distance to the City, 1980 and 2010

Neighborhood type	Mean distance (miles)	
	1980	2010
NW-A	5.1	4.4
H	1.7	5.4
B	6.8	7.8
BH	9.0	10.0
W	29.1	35.1
WA	22.4	22.9
WH	17.2	21.9
WHA	14.4	18.8
WB	22.0	18.7
WBA	16.0	14.0
WBH	22.7	25.7
WBHA	14.7	20.3
Total/average	18.3	18.3

Table 4

a. Odds-ratio of neighborhood adjacency in 1980												
1980 type	NW-A	H	Neighborhood type of 10 nearest neighbors							WBH	WBHA	TOTAL
			B	BH	W	WA	WH	WHA	WB			
NW-A	14.5	4.4	4.0	4.6	0.0	0.0	0.5	0.4	0.0	3.0	1.8	230
H	4.7	132.0	1.1	8.7	0.0	0.0	2.8	0.3	0.0	0.2	0.5	120
B	3.8	1.0	104.3	2.6	0.0	0.0	0.2	0.1	0.5	0.7	0.6	2,340
BH	4.4	7.0	3.2	10.7	0.2	0.0	2.1	0.2	0.9	0.2	5.0	260
W	0.0	0.0	0.0	0.2	18.0	0.6	0.9	0.2	2.0	0.5	0.7	2,870
WA	0.0	0.0	0.0	0.0	0.6	17.9	0.1	0.5	0.3	0.6	0.1	4,870
WH	0.5	3.0	0.3	3.6	1.0	0.1	9.8	1.1	1.2	0.4	2.9	1,360
WHA	0.5	0.6	0.1	0.2	0.2	0.5	1.2	16.5	0.2	0.1	0.5	3,140
WB	0.0	0.0	0.7	1.4	1.3	0.2	1.5	0.2	20.5	3.0	2.7	420
WBA	3.3	0.2	0.7	0.1	0.6	0.6	0.3	0.1	2.3	22.2	1.0	720
WBH	1.9	1.2	0.8	4.6	0.5	0.1	3.3	0.5	1.8	1.0	11.2	580
WBHA	1.6	0.5	0.3	0.8	0.2	0.3	0.6	0.7	0.2	1.1	1.0	1,340
TOTAL	206	135	2,406	284	2,783	4,831	1,295	3,117	400	734	637	18,250

b. Odds-ratio of neighborhood adjacency in 2010												
2010 type	NW-A	H	Neighborhood type of 10 nearest neighbors							WBH	WBHA	TOTAL
			B	BH	W	WA	WH	WHA	WB			
NW-A	70.7	5.3	1.6	1.4	0.0	0.1	0.6	0.4	0.0	1.6	0.3	170
H	4.2	47.8	0.3	6.5	0.0	0.0	2.1	0.1	0.3	0.1	0.5	430
B	1.2	0.2	135.0	1.2	0.0	0.0	0.0	0.0	1.0	0.5	0.2	2,440
BH	1.3	5.6	1.6	19.3	0.0	0.0	0.8	0.1	0.6	0.1	1.9	1,090
W	0.0	0.0	0.1	0.1	32.7	1.4	2.2	0.4	1.3	0.3	1.0	720
WA	0.1	0.0	0.0	0.0	1.5	11.2	0.2	1.1	0.0	1.8	0.1	2,640
WH	0.7	2.5	0.0	1.0	2.2	0.2	12.5	1.1	0.3	0.0	1.4	1,140
WHA	0.5	0.2	0.0	0.1	0.3	1.1	1.1	9.5	0.0	0.1	0.3	3,460
WB	0.0	0.3	1.1	0.8	0.8	0.0	0.3	0.0	48.9	0.3	4.1	430

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b. Odds-ratio of neighborhood adjacency in 2010																			
			Neighborhood type of 10 nearest neighbors																
2010 type	NW-A	H	B	BH	W	WA	WH	WHA	WB	WBA	WBH	WBHA	TOTAL						
WBA	2.3	0.0	0.4	0.2	0.2	1.8	0.0	0.1	0.3	13.4	0.1	1.7	1,030						
WBH	0.2	0.6	0.3	2.3	0.6	0.0	1.3	0.2	4.8	0.1	14.4	0.7	1,370						
WBHA	0.2	0.2	0.1	0.2	0.3	0.6	0.5	1.0	0.2	1.7	0.9	6.8	3,330						
TOTAL	156	441	2,515	1,128	592	2,608	1,112	3,438	442	1,023	1,452	3,343	18,250						