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Neighborhood Change in Metropolitan America, 1990 to 2010

Fang Wei[1] and Paul L. Knox[2]

Abstract

Using *k*-means cluster analysis and discriminant analysis, this study systematically examines the trajectories of neighborhood change at the census tract level between 1990 and 2010 for all metropolitan and micropolitan areas of the United States. Seven types of neighborhoods are identified using a visualization technique of clustergram and other statistical tests. A sequence of neighborhood change has been identified. This research reveals the primarily stable nature of neighborhoods and the polarization of inequality in neighborhoods. Understanding changes that are not within the category of either downgrading or upgrading is very important for policy makers and practitioners in providing appropriate local services, support, or opportunities for the residents.

Keywords

neighborhood typology, neighborhood change, trajectories and sequences

Introduction

Across the entire body of the "New Metropolis" identified by Knox (2008), a great deal of socioeconomic diversity has emerged. The increased diversity of metropolitan America may suggest a corresponding increase in the diversity of neighborhood change. Thus, neighborhoods may go beyond the simple changes in income or racial composition, and may change in a more

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complex way that is difficult to anticipate (Coulton, Theodos, and Turner 2009). Yet we know relatively little about these new patterns of neighborhood change in metropolitan America.

Neighborhood change has been a major concern of urban planners and policy makers for several decades. In the recent literature, neighborhood transition generally refers to one of several specific changes in household/family income, poverty rate, or racial/ethnic composition, and, to a lesser degree, shifts in owner-occupied housing price, occupation, or unemployment rate (Denton and Massey 1991; Galster et al. 2003; Hanlon, Vicino, and Short 2006; Kitchen and Williams 2009; Morrow-Jones and Wenning 2005; Schwab 1987). In reality, however, a neighborhood is a geographic unit with a bundle of spatially-based attributes (Galster 2001). Using the change of a single indicator as a proxy for neighborhood transition may neglect other important factors that crucially shape the trajectories of neighborhood change.

Many studies have investigated the increased diversity of neighborhoods across a multidimensional array of indicators (Hanlon, Vicino, and Short 2006; Mikelbank 2004; Orfield 2002), but these studies have merely constructed neighborhood typologies without exploring the changes that accompany those typologies. Several empirical studies have examined neighborhood change between two consecutive (census) years (Kitchen and Williams 2009; Mikelbank 2006; Vicino 2008). In these studies, neighborhoods either remained stable, or experienced upward or downward movements during the study period. The trajectories and sequences of neighborhood change over a relatively long time cannot be identified in those studies.

Although current studies do suggest a gradually increased interest in the multidimensional and longitudinal neighborhood transition (Mikelbank 2011; Morenoff and Tienda 1997; Séguin, Apparicio, and Riva 2012), existing research has focused largely on a single metropolitan area. Generalizing the results of these studies to places in other geographic locations is difficult. Currently, to my knowledge, few studies have investigated multidimensional neighborhood change over more than two consecutive (census) years at the national level.

By analyzing decennial tract-level data over three consecutive census years (1990, 2000, and 2010) for all metropolitan and micropolitan areas in the United States, this study documents the evolving social ecological structures of American metropolitan areas and systematically evaluates the trajectories and sequences of those changes. This study will address the following research questions:

> ***Research Question 1:*** What are the typologies of neighborhoods with multidimensional attributes?

Research Question 2: Other than succession and gentrification, what other patterns of neighborhood change can be observed?
Research Question 3: Will a diversity of neighborhood changes be observed in metropolitan America?
Research Question 4: Does change vary across regions?
Research Question 5: What implications do the trajectories and sequences of neighborhood change have for neighborhood theories and practices?

By answering these questions, this work will provide chronologically and geographically systematic insight into American metropolitan regions, and a chance to test the realities of neighborhood change over the past two decades.

Background

Much discussion on neighborhood change has focused on income/racial change, gentrification, and/or changes in residential diversity. The classic models—invasion-succession model (Burgess 1925), filtering model (Hoyt 1939), and neighborhood life-cycle model (Downs 1981; Hoover and Vernon 1959)—have emphasized downward movement as the dominant component of neighborhood change. These models have been identified as the most important theories of neighborhood change (Galster, Cutsinger, and Lim 2007; Schwirian 1983). Neighborhoods change as higher-income residents are replaced by lower-income residents. Residents begin to move when a neighborhood is perceived to have deteriorated to a certain degree, and the housing chain finally ends in concentrated abandonment and permanent vacancies (Bier 2001; Megbolugbe, Hoek-Smit, and Linneman 1996). For example, based on the neighborhood life-cycle model formulated by Hoover and Vernon (1959), urban areas experience a linear, evolutionary process involving five stages: development, transition, downgrading, thinning out, and renewal. Neighborhood life-cycle change is associated with a range of changes in demographic, socioeconomic, and physical conditions of neighborhoods. Attempts have been made to reformulate these stages in Hoover and Vernon's model. Birch (1971) included seven stages in the theory of urban growth: rural, first wave of development, fully developed, high-quality residential, packing, thinning, and recapture. Downs (1981) identified five stages of neighborhood life cycle: stable and viable, minor decline, clear decline, heavily deteriorated, and unhealthy and nonviable. The later stages of the life cycle are dominated by lower-status individuals and racial minorities. In these classic models, neighborhood change follows the predictable downward succession, and the socioeconomic status of these neighborhoods declines gradually before renewal (Fong and Shibuya 2003). Decades ago, the realities of neighborhood transition could be captured using these relatively simple models, in which neighborhood transition generally refers to specific changes in income or racial/ethnic composition. However, these models may overlook the current and emerging issues surrounding the increased complexity of neighborhood change in metropolitan America.

The orthodox view of the inevitability of neighborhood succession in terms of income or race has been challenged by some more recent studies of neighborhood change. Gentrification, specifically, suggests an upgrading process in which higher-income residents displace lower-income households in a neighborhood. This process has the potential to revitalize distressed cities, though the threat of displacement as a result of gentrification has become a major concern (Freeman 2005; Lees, Slater, and Wyly 2008; Ley and Dobson 2008). Although gentrification does not occur evenly over time and space, certain types of neighborhoods in many cities undergoing revitalization have experienced substantial gentrification over the past several decades (Coulton, Theodos, and Turner 2009; Hudson 1980; Newman and Ashton 2004). In addition to the gentrification observed in central cities, suburbs, especially older, inner-ring suburbs, have also experienced the class-based processes of neighborhood upgrading (Charles 2011).

Most of these studies on neighborhood change have examined changes between two points in time (Kitchen and Williams 2009; Mikelbank 2006; Vicino 2008), either with respect to income/racial change or gentrification. The trajectories and sequences of neighborhood change cannot be identified in these studies. Only a few studies have examined multidimensional attributes to explore longitudinal changes in neighborhoods. For example, employing a cluster analysis on 825 census tracts from 1970 to 1990 in Chicago, Morenoff and Tienda (1997) developed a multidimensional typology of neighborhoods with a set of 10 variables. The typology consists of four ecological categories: stable middle-class, gentrifying yuppie, transitional working class, and ghetto underclass. Based on the four typologies, this study examined the path of neighborhood change and documented the increasing spatial polarization and emergence of Hispanic neighborhoods in Chicago. Performing a cluster analysis using tract-level demographic, socioeconomic, and housing data across four decades, Mikelbank (2011) created a combined taxonomy of neighborhood conditions in metropolitan Cleveland. He revealed five types of neighborhoods: struggling, struggling African-American, stability, new starts, and suburbia. Mikelbank also investigated the ways in which these neighborhoods changed through time and across space. He detected that suburban neighborhoods were decreasing and migrating further away from the urban core. Although these studies do suggest a gradually increased interest in the multidimensional neighborhood transition, existing research has focused largely on a single metropolitan area.

Furthermore, many studies have investigated the increased diversity of neighborhoods across a multidimensional array of indicators, but these studies have merely constructed neighborhood typologies without exploring the changes that accompany those typologies. By constructing neighborhood typologies, those recent cross-sectional studies have shown that the dichotomy between poor black cities and wealthy white suburbs has been steadily changed. The transformation of the demographic and economic structure of metropolitan areas has led to a growing heterogeneity of metropolitan America, especially in the suburbs (Hanlon, Short, and Vicino 2010; Hanlon, Vicino, and Short 2006; Mikelbank 2004; Orfield 2002). Some studies also have investigated changes in the diversity of contemporary U.S. metropolitan areas. For example, using scaled entropy to measure racial diversity, Chipmana et al. (2012) investigated the evolving patterns of neighborhood change in Chicago from 1990 to 2010. They found that the dominant trend of neighborhood change in the Chicago region was the transformation from low-diversity to increasingly diverse tracts in the subregions. Although these studies document an overall increase in residential diversity in certain metropolitan areas, other areas may experience increased income or racial segregation. Given the increased diversity of metropolitan areas, both in central cities and suburbs, we assume that the diversity of neighborhood change will also increase to a certain extent. These new forms of change will go beyond the simple downward or upward process, in which lower-income and higher-income, or black and white households replace each other. They will also go beyond a linear, evolutionary process involving predictable neighborhood stages.

In general, the literature on neighborhood change provides surprisingly little information about the trajectories and sequences of changes across a multidimensional array of indicators at the national level. The limitations of current research and inquiry into changes in metropolitan America reveal that the issue has continued to be understudied.

Data and Method

This study uses census data from the 1990, 2000, and 2010 decadal censuses. The data used in this analysis are derived from Longitudinal Tract Data Base (LTDB) and prepared by Spatial Structures in the Social Sciences (S4). The LTDB data set has been standardized to 2010 boundaries. This study focuses on neighborhood change in metropolitan and micropolitan statistics areas in the United States for the three decennial years. According to the Census Bureau, census tracts are "homogeneous with respect to population characteristic, economic status, and living conditions" to obtain "pure" basic observation units. In this article, a neighborhood is defined as a census tract, which is especially appropriate for comparisons at the national level. For each census year during this period, there are 65,535 tracts in the original data set. We have deleted 4,730 tracts from each census year because these tracts do not belong to any metropolitan or micropolitan area according to the Office of Management and Budget's (OMB) 2009 definitions of these terms. In addition, those tracts with a population less than 500 have been excluded from the analysis. The reason for eliminating these tracts was to avoid estimates based on a small amount of data (Bench 2003). After excluding these tracts, the data in this study include 58,801, 59,837, and 60,078 tracts for 1990, 2000, and 2010, respectively. All tracts in each of the three census years were entered into one clustering procedure. Thus, the total number of observations considered in the cluster analysis is 178,716.

According to the literature, many variables are used to develop neighborhood typologies. These variables are related to race and ethnicity, age structure, family structure, household/family income, educational attainment, unemployment, immigrant status, and housing characteristics (Hanlon 2009; Kitchen and Williams 2009; Mikelbank 2004, 2011; Morenoff and Tienda 1997). All these variables are powerful indicators that differentiate categories of neighborhoods. In this study, after deleting highly correlated candidate variables, 16 variables that related to these dimensions were divided into three major categories: demographic, socioeconomic, and housing characteristics.

Each of these variables for each tract was standardized as a *z*-score relative to all the other tracts in the same census year. We followed the pooled sample and *z*-score procedures introduced by Mikelbank (2011). The data were standardized for two reasons. First, variables with different scales or magnitudes have different effects on the final similarity measure in cluster analysis (Vickers and Rees 2007). Second, problems occur when comparing variables across different years. Therefore, for each variable to be represented equally in the cluster analysis, standardization of the data is necessary. A positive *z*-score reflects a level higher than the national average, and a negative *z*-score reflects a lower-than-average level.

Cluster analysis generally offers two options when one is facing with the task of classifying all census tracts into certain types of groups: the single-tier methods typified by *k*-means partitioning, and the hierarchical methods. In this study, *k*-means cluster analysis was chosen to identify neighborhood typologies over the time period of 1990 to 2010. First, the idea behind hierarchical clustering fits better with biology, in which clusters are formulated gradually. This is not necessarily the case in the field of neighborhood

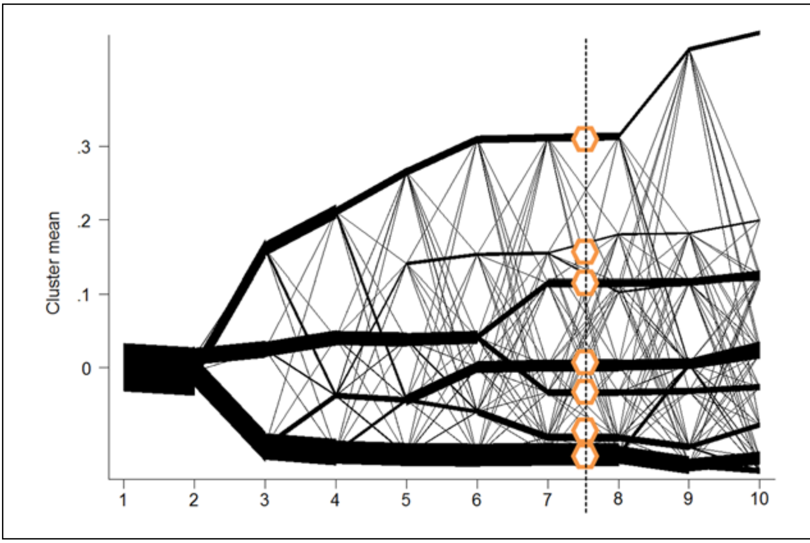

Figure 1. Visualization of clusters via clustergram.

research. Second, clusters formed in previous steps can never be corrected in hierarchical clustering, so any faulty decisions cannot be undone. The *k*-means method, however, iterates the grouping process and adjusts grouping until a satisfactory dissimilarity coefficient is achieved, ensuring that mistakes may be overcome. Finally, the *k*-means method is good for large sample calculation (Vickers and Rees 2007), as in this research. The *k*-means method, therefore, serves as a good alternative to hierarchical clustering in neighborhood research.

Given that most large data sets may contain masking outliers and other deviations, nonhierarchical clustering methods rarely yield a clear partitioning structure of the data on a first pass. This complicates the identification and selection of a stable number of clusters. One way to overcome the cluster selection problem is by relying on data visualization, using clustergrams that guide the choice of the number of clusters. We adopted this strategy and followed the visualization procedure introduced by Henning and Christlieb (2002) and Schonlau (2004). The clustergram (Figure 1) is used to examine how the members of these clusters are formed as the number of clusters increases. The width of the line segments indicates the number of observations that are assigned to a cluster.

As one of many multivariate techniques, the basic objective of discriminant analysis is to build rules or classification schemes that can classify observations into appropriate population (Johnson 1998). It can also be used to describe or reveal major differences among groups (Stevens 2001). In this study, discriminant analysis was used to test the internal validity of the cluster analysis (Hill, Brennan, and Wolman 1998) and to explore the relative importance of variables in differentiating neighborhood typologies.

Results

Cluster Identification

Before jumping to the task of analyzing neighborhood change, we need to specify the number of neighborhood clusters using a *k*-means cluster analysis. Previous empirical studies have produced classifications of between 4 and 10 distinct types of neighborhoods (Hanlon 2009; Hanlon, Short, and Vicino 2010; Mikelbank 2004; Orfield 2002). In seeking to delineate the neighborhood change in U.S. metropolitan areas over time, a similar degree of differentiation is therefore anticipated. No single algorithm used in *k*-means cluster analysis is perfect for any one clustering task. Usually, several algorithms are applicable, and academic insights and experiences play an important role in producing satisfactory results. A *k*-means cluster analysis partitioned the pooled tract-level data of 178,716 observations into 2 to 10 groups by selecting different initial groups in STATA (data analysis and statistical software). A clustergram was plotted multiple times based on various clustering algorithms. These graphs were then compared with each other to observe the stability of the cluster formation. By examining the Calinski/Harabasz index, the clustergram, the meaning of each cluster selection, and the cross-validation in JMP (statistical software developed by SAS Institute) for all those tentative results, a seven-cluster solution, with the first *k* observations as the initial group centers, was confirmed as the optimal model.

Here, the results of clustering process with the first *k* observations as the initial group centers are reported. First, based on the Calinski/Harabasz pseudo-F test, the two-, three-, four-, and seven-group solutions had the largest values (Table 1), so they were selected as the candidates for the final choice of clusters. A clustergram (Figure 1) was computed for the pooled data of the 16 variables. The clustergram indicated the relative stability of the seven-cluster choice even at the higher-order specifications. Then, the means and standard deviations of the initial two-, three-, four-, and seven-cluster models were compared, and the seven-group solution provided more detailed and accurate descriptions of neighborhood characteristics in the

Table 1. Calinski/Harabasz Index.

Number of Clusters	Calinski/Harabasz Pseudo-*F*
2	38,098.97
3	35,550.98
4	29,755.40
5	27,152.59
6	25,455.20
7	27,801.44
8	25,041.71
9	23,895.98
10	22,661.29

United States. Finally, cross-validation in JMP confirmed this seven-cluster solution.

Neighborhood Typology

The important questions following the cluster analysis are as follows: (1) How well are the neighborhoods classified? and (2) Which variables used in the *k*-means cluster analysis best explain the neighborhood differentiation? To answer these questions, discriminant analysis was employed to study the differences between groups of neighborhoods with respect to multiple variables simultaneously. The percentage of misclassified neighborhoods was 7.2, which meant that more than 92% of neighborhoods were appropriately classified. A canonical discriminant function is a linear combination of the variables, which is used to study the nature of group differences. Table 2 shows the eigenvalues of each function and measures of their importance. An eigenvalue indicates the proportion of variance explained. Functions with larger eigenvalues are more powerful discriminators. A high canonical correlation indicates a function that discriminates well. The first four discriminant functions, which had the largest eigenvalues, explained more than 85% of total variances (cumulative percentage). They significantly contributed to our understanding of group differences. The last two functions, which had small eigenvalues, relative percentages, and canonical correlations, were weak relative to the first four functions.

The relative importance of the variables can be determined by examining the magnitude of the standardized score coefficients of each function (Table 3): The larger the magnitude (ignoring the sign), the greater the variable's contribution. For Functions 1 and 2, the percentage of black and Hispanic residents made the greatest contribution. Educational attainment had the highest standardized coefficient in Function 3. Other variables,

Table 2. Eigenvalues and Measures of Importance.

Canonical Discriminant Function	Eigenvalue	Relative Percentage	Cumulative Percentage	Canonical Correlation
1	3.373	33.129	33.129	.878
2	2.568	25.224	58.353	.848
3	1.427	14.016	72.370	.767
4	1.289	12.655	85.025	.750
5	0.841	8.264	93.289	.676
6	0.683	6.711	100	.637

Table 3. Standardized Canonical Discriminant Function Coefficients.

Variables	Function 1	Function 2	Function 3	Function 4
% persons age 17 years and below	−0.123	0.002	0.098	−0.027
% persons age 60 years and above	0.057	0.172	−0.255	0.571
% persons of white race, not Hispanic origin	0.243	0.076	−0.223	−0.123
% persons of black race, not Hispanic origin	−0.536	0.500	0.143	0.070
% persons of Hispanic origin	−0.334	−0.578	−0.243	0.129
% owner-occupied housing units	0.167	0.129	−0.120	0.041
% vacant housing units	0.065	0.177	−0.318	0.719
Median monthly contract rent	0.085	−0.026	0.266	0.244
Median home value	0.071	0.011	0.246	0.141
% foreign-born	−0.080	−0.229	−0.216	0.101
% persons with at least a 4-year college degree	−0.046	−0.123	0.371	0.150
% unemployed	−0.194	0.109	0.131	0.081
% manufacturing employees (by industries)	−0.031	0.046	−0.158	−0.160
Median household income	0.067	−0.099	0.243	0.122
% structures built more than 30 years ago	−0.175	0.025	−0.022	−0.094
% household heads moved into a unit less than 10 years ago	0.046	−0.044	−0.038	0.120

such as housing values, rent, household income, and immigrant percentage, made somewhat similar contributions to this discriminant function. For Function 4, the percentage of vacant housing units was most important, and the percentage of persons more than 60 years old is the second most significant variable. As expected, race and ethnicity, immigrant percentage, socioeconomic status, and housing characteristics played important roles in the differentiation of neighborhood typologies, which are consistent with findings in the literature of neighborhood typologies (Hanlon 2009; Hanlon, Vicino, and Short 2006; Orfield 2002; Shevky and Bell 1955). According to the importance of variables (Table 3) and the *z*-score means of the variables in each cluster (Table 4), the seven clusters are labeled as *middle-class, white/lower, mix/renter, black/poor, white/aging, elite*, and *immigrant*.

Elite neighborhoods represent the enclaves of very wealthy households of highly-educated professionals distinguished by their exceptionally high household incomes, homeownership rates, median rents, and home values. They also have above-average shares of foreign-born populations, seniors, and old housing stocks. In particular, *elite* neighborhoods have the lowest vacancy rate and residential mobility (percentages of household heads who moved into a unit less than 10 years ago).

White/lower neighborhoods, constituting roughly one-third of tracts during the period of this study, consist of most white households in relation to the production of goods and services. They are racially more homogeneous than the *elite* neighborhoods, with the lowest shares of foreign-born and Hispanic populations. *White/lower* neighborhoods have household incomes, educational attainment, median rents, and home values below the national averages.

Middle-class neighborhoods represent a halfway house between the *elite* and *white/lower* neighborhoods, occupying roughly 15% to 20% of tracts over each of the last three census years. They are constituted mostly of white-collar professionals with higher educational attainment and household incomes than *white/lower* neighborhoods. The income thresholds follow Beeghley's (2004) definition for middle-class using a combined household income. In particular, *middle-class* neighborhoods are family-oriented, with higher percentages of persons aged 17 years and below, and higher home-ownership rates. They also have the lowest shares of old housing stocks and lower vacancy rates, and the median rents and home values are well above the national average.

With racial composition, median household incomes, and unemployment rates resembling those in *white/lower* areas, *white/aging* neighborhoods consist of households with a substantially higher percentage of white populations and seniors. This cluster also has the highest percentage of vacant housing units and a higher homeownership rate. The educational attainment, median rents, and housing values, however, are around the national average. In

Table 4. *Z*-Score Means Across Clusters.

Variables	Middle-Class	White/Lower	Mix/Renter	Black/Poor	White/Aging	Elite	Immigrant
Demographic							
% persons age 17 years and below	0.50	−0.04	−1.16	0.65	−1.34	−0.36	0.85
% persons age 60 years and above	−0.60	0.27	−0.26	−0.22	2.41	0.29	−0.61
% persons of white race, not Hispanic origin	0.34	0.62	−0.05	−1.68	0.67	0.35	−1.50
% persons of black race, not Hispanic origin	−0.29	−0.31	−0.05	2.57	−0.47	−0.44	−0.14
% persons of Hispanic origin	−0.20	−0.43	−0.05	−0.31	−0.33	−0.28	2.29
% foreign-born	−0.25	−0.55	0.36	−0.32	−0.25	0.27	1.78
Socioeconomic status							
% persons with at least a 4-year college degree	0.45	−0.45	0.66	−0.76	−0.02	1.43	−0.75
% unemployed	−0.50	−0.17	−0.07	1.60	−0.17	−0.60	0.65
% manufacturing employees (by industries)	−0.21	0.56	−0.67	−0.19	−0.73	−0.35	0.14
Median household income	0.67	−0.28	−0.40	−0.92	−0.23	1.69	−0.57
Housing characteristics							
% owner-occupied housing units	0.53	0.41	−1.32	−0.75	0.55	0.57	−0.84
% vacant housing units	−0.32	−0.11	−0.01	0.52	2.86	−0.52	−0.18
Median monthly contract rent	0.35	−0.57	0.16	−0.60	0.08	1.52	0.02
Median home value	0.06	−0.50	0.18	−0.60	0.02	1.78	0.01
% structures built more than 30 years ago	−1.19	0.24	0.20	0.71	−0.78	0.31	0.37
% household heads moved into a unit less than 10 years ago	0.70	−0.55	0.96	−0.23	0.21	−0.67	0.32

particular, this cluster is the smallest among the seven clusters, constituting only 4.11% to 4.52% of tracts for each census year.

The lowest homeownership rates and highest mobility are the main distinguishing features of the *mix/renter* neighborhoods. The median household income in this cluster is lower than the four types of clusters above. This is consistent with the notion that mobility rates are higher among lower-income households and renters (Coulton, Theodos, and Turner 2009). This cluster is also characterized by the lower percentage of persons aged 17 years and below. Households in this cluster also have higher educational attainment and foreign-born populations. Approximately, 11% to 12% of tracts in each census year can be classified in this cluster.

The last two clusters have come to be known as "underclass," based on the model of Thompson and Hickey (2005), who placed roughly one-fifth of households in this class. In this study, the *black/poor* and *immigrant* neighborhoods constitute a total of 18.58% to 23.06% of tracts in each census year. They comprise socially and economically disadvantaged households, consisting mainly of the frequently unemployed population. In particular, *black/poor* neighborhoods are characterized by the highest percentages of the black population, unemployment rates, and old housing stocks. Households in this cluster also have the lowest household incomes, educational attainment, median rents, and home values. The most distinctive characteristic of *immigrant* neighborhoods is that they have the highest share of Hispanics and foreign-born populations and the lowest proportion of white residents. This cluster also encompasses census tracts that have much lower than average household incomes. This is consistent with the findings of Simpson, Gavalas, and Finney (2008), who showed that immigration concentration is traditionally associated with poverty.

Trajectories of Neighborhood Change

Before describing the trajectories of neighborhood change, several concepts that are used in this study need to be defined here. Neighborhood change is defined as the socioeconomic transition of a neighborhood from one cluster to another between census years. Upward movement, or upgrading, is defined as a lower-class neighborhood moving upward into an upper-class neighborhood in terms of median household income, and downward movement, or downgrading, is when an upper-class neighborhood moves downward into a lower-class neighborhood.

Temporal changes across typologies. Table 5 highlights the changes in the numbers and percentages of tracts for the seven clusters in 1990, 2000, and 2010.

Table 5. The Numbers and Percentages of Tracts Across Clusters Over Time.

	Middle-Class	White/Lower	Mix/Renter	Black/Poor	White/Aging	Elite	Immigrant
1990							
Tracts	11,749	20,505	6,473	5,358	2,656	6,435	5,570
Share (%)	19.98	34.87	11.01	9.11	4.52	10.94	9.47
2000							
Tracts	10,950	20,332	6,837	5,841	2,569	6,210	7,038
Share (%)	18.30	33.98	11.43	9.76	4.29	10.38	11.76
2010							
Tracts	9,323	20,070	7,164	6,004	2,468	7,064	7,852
Share (%)	15.52	33.41	11.92	9.99	4.11	11.76	13.07

At the beginning as well as by the end of the study period, the *white/lower* and *middle-class* neighborhoods outnumbered the other clusters, while *white/aging* accounted for the smallest number of tracts. The *immigrant* and *black/poor* neighborhoods, featuring the two lowest household incomes among the seven clusters, grew steadily over time. In particular, America has witnessed a dramatic increase of *immigrant* neighborhoods, especially in the South and West. *Immigrant* neighborhoods accounted for 9.47% of all tracts in 1990, and by 2010 they represented more than 13%. While the share of *elite* neighborhoods declined moderately from 1990 to 2000, it began to rise after 2000, reaching its peak in 2010. The data show a shrinking of the middle layers in terms of household income. The *middle-class* neighborhoods accounted for almost 20% of all tracts in 1990, but by 2010 they represented only 15.5%. Increases in the size and shares of neighborhoods on the two extremes, the top and the bottom, were paralleled by the simultaneous decline of the middle layers. Thus, neighborhoods in metropolitan America have become more polarized over time.

Sequences of neighborhood change. A sequence of neighborhood change could be identified based on the cluster in each subsequent census year. There are 280 different sequences of neighborhood change. Table 6 shows the first 39 sequences, which explain more than 90% of the total tracts. Each three-digit number represents a neighborhood type in each census year from 1990 to 2010. For example, the sequence "227" specifies those Type 2 tracts (*white/lower*) in 1990 that remained the same in 2000, and changed to Type 7 (*immigrant*) in 2010.

The most striking finding of Table 6 is that metropolitan America is dominated by neighborhoods that are relatively stable in their socioeconomic attributes. This neighborhood stability may challenge the long-established

Table 6. The First 39 Sequences of Neighborhood Transitions.

Cluster Change 1990-2010	Tracts	Tracts (%)
222	15,666	26.868
111	5,689	9.757
666	4,727	8.107
777	4,605	7.898
444	4,193	7.191
333	4,036	6.922
555	1,748	2.998
112	1,279	2.194
122	998	1.712
211	718	1.231
116	635	1.089
221	593	1.017
224	499	0.856
377	499	0.856
177	427	0.732
223	401	0.688
166	397	0.681
244	389	0.667
277	384	0.659
133	347	0.595
227	341	0.585
212	335	0.575
113	329	0.564
117	309	0.530
233	290	0.497
337	264	0.453
773	247	0.424
662	234	0.401
443	215	0.369
622	215	0.369
121	207	0.355
336	203	0.348
477	202	0.346
633	195	0.334
636	178	0.305
447	172	0.295
552	150	0.257
344	148	0.254
733	145	0.249

Note: 1 = middle-class; 2 = white/lower; 3 = mix/renter; 4 = black/poor; 5 = white/aging; 6 = elite; 7 = immigrant.

assumptions of neighborhood succession. The first seven sequences (222, 111, 666, 777, 444, 333, and 555), or neighborhoods that remained stable for all three census years, accounted for 69.74% of the total tracts. Another aspect of neighborhood stability is highlighted in Table 6: Neighborhoods tended to remain the same over at least two successive census years. This includes two scenarios. The first scenario is that a neighborhood had the same type in 1990 and 2000, and a different type in 2010. The other scenario is that a neighborhood had the same type in 2000 and 2010, and a different type in 1990. Three sequences (212, 121, and 636) in Table 6 reflect neighborhoods that reverted to their original state; in other words, they are another form of stable neighborhood. In sum, the sequences of neighborhood change reveal a tendency of most neighborhoods to remain in one stage of the life cycle over at least two successive census years.

Trajectories of neighborhood change. The large-scale stability of neighborhoods raises concerns about the trajectories of change among the seven clusters. Tables 7, 8, and 9 display a total of 49 types of neighborhood change among the seven clusters during the three periods of time: 1990 to 2000, 2000 to 2010, and 1990 to 2010. The main diagonal reveals that the stable neighborhoods dominate metropolitan America, which further confirms the results of the sequences of neighborhood change. But which types of neighborhoods are more likely than others to remain stable over time? What are the other patterns of neighborhood change? Are there regional differences among these changes?

The data used in this study included three consecutive census years (1990, 2000, and 2010). Similar patterns of neighborhood change have been found during three periods of time (the 1990s, 2000s, and from 1990 to 2010). The main difference is that in the 1990s, *elite* neighborhoods were less likely to remain in the same cluster compared with those in the other two time periods. Many of the mortgage foreclosures related to subprime loans were generated in the late-1990s, which speed up the housing filtering process (Li and Morrow-Jones 2010). This may contribute to overall neighborhood change, especially for *elite* neighborhoods, to a certain extent.

Tables 7 and 8 show neighborhood changes among the seven clusters in the 1990s and 2000s. To grasp the general trend of neighborhood change, the following discussion mainly focuses on neighborhood change from 1990 to 2010 (Table 9). By discussing the trajectories of neighborhood change from 1990 to 2010 within the framework of category ranking (neighborhood stability, succession, and downgrading) identified by median household income, changes that were not explained by those categories were detected in this study. By doing so, this study attempted to challenge traditional models of sequential neighborhood change. Neighborhood change is complicated and

Table 7. Neighborhood Transitions from 1990 to 2000.

From Cluster State: Neighborhood Type in 1990	To Cluster State: Neighborhood Type in 2010								
	Middle-Class	White/Lower	Mix/Renter	Black/Poor	White/Aging	Elite	Immigrants	Total	% Neighborhoods Remaining in the Same Cluster
Middle-class									
Tracts (%)	**8,444** (72.01)	1,386 (11.82)	515 (4.39)	152 (1.30)	115 (0.98)	630 (5.37)	484 (4.13)	11,726 (100)	72.01
White/lower									
Tracts (%)	1,128 (5.50)	**17,779** (86.74)	448 (2.19)	466 (2.27)	145 (0.71)	114 (0.56)	418 (2.04)	20,498 (100)	86.74
Mix/renter									
Tracts (%)	182 (2.83)	202 (3.14)	**4,972** (77.25)	257 (3.99)	47 (0.73)	175 (2.72)	601 (9.34)	6,436 (100)	77.25
Black/poor									
Tracts (%)	31 (0.58)	222 (4.15)	119 (2.22)	**4,742** (88.62)	8 (0.15)	4 (0.07)	225 (4.20)	5,351 (100)	88.62
White/aging									
Tracts (%)	142 (5.36)	225 (8.49)	118 (4.45)	11 (0.42)	**2,101** (79.31)	25 (0.94)	27 (1.02)	2,649 (100)	79.31
Elite									
Tracts (%)	233 (3.62)	398 (6.19)	411 (6.39)	39 (0.61)	27 (0.42)	**5,192** (80.72)	132 (2.05)	6,432 (100)	80.72
Immigrants									
Tracts (%)	67 (1.20)	68 (1.22)	179 (3.22)	160 (2.88)	15 (0.27)	23 (0.41)	**5,051** (90.80)	5,563 (100)	90.80
Total	10,227	20,280	6,762	5,827	2,458	6,163	6,938	58,655	

Note: Values in bold represent the neighborhoods that remained stable.

Table 8. Neighborhood Transitions from 2000 to 2010.

From Cluster State: Neighborhood Type in 2000	To Cluster State: Neighborhood Type in 2010							Total	% Neighborhoods Remaining in the Same Cluster
	Middle-Class	White/Lower	Mix/Renter	Black/Poor	White/Aging	Elite	Immigrants		
Middle-class									
Tracts (%)	**6,739** (66.27)	1,667 (16.39)	401 (3.94)	117 (1.15)	84 (0.83)	800 (7.87)	361 (3.55)	10,169 (100)	66.27
White/lower									
Tracts (%)	861 (4.27)	**17,282** (85.75)	563 (2.79)	604 (3.00)	155 (0.77)	262 (1.30)	426 (2.11)	20,153 (100)	85.75
Mix/renter									
Tracts (%)	212 (3.16)	271 (4.04)	**5,184** (77.32)	183 (2.73)	50 (0.75)	429 (6.40)	376 (5.61)	6,705 (100)	77.32
Black/poor									
Tracts (%)	30 (0.52)	135 (2.33)	334 (5.77)	**4,976** (85.94)	9 (0.16)	38 (0.66)	268 (4.63)	5,790 (100)	85.94
White/aging									
Tracts (%)	126 (5.16)	208 (8.51)	82 (3.36)	11 (0.45)	**1,960** (80.20)	30 (1.23)	27 (1.10)	2,444 (100)	80.2
Elite									
Tracts (%)	221 (3.59)	380 (6.17)	129 (2.09)	17 (0.28)	46 (0.75)	**5,331** (86.57)	34 (0.55)	6,158 (100)	86.57
Immigrants									
Tracts (%)	80 (1.16)	46 (0.67)	352 (5.10)	80 (1.16)	11 (0.16)	102 (1.48)	**6,225** (90.27)	6,896 (100)	90.27
Total	8,269	19,989	7,045	5,988	2,315	6,992	7,717	58,315	

Note: Values in bold represent the neighborhoods that remained stable.

Table 9. Neighborhood Transitions from 1990 to 2010.

From Cluster State: Neighborhood Type in 1990	To Cluster State: Neighborhood Type in 2010							Total	% Neighborhoods Remaining in the Same Cluster
	Middle-Class	White/Lower	Mix/Renter	Black/Poor	White/Aging	Elite	Immigrants		
Middle-class									
Tracts (%0	**6,123** (52.47)	2,421 (20.75)	752 (6.44)	279 (2.39)	142 (1.22)	1,108 (9.49)	845 (7.24)	11,670 (100)	52.47
White/lower									
Tracts (%)	1,336 (6.55)	**16,225** (79.60)	731 (3.59)	932 (4.57)	203 (1.00)	160 (0.78)	797 (3.91)	20,384 (100)	79.60
Mix/renter									
Tracts (%)	266 (4.16)	253 (3.95)	**4,360** (68.13)	305 (4.77)	58 (0.91)	357 (5.58)	801 (12.52)	6,400 (100)	68.13
Black/poor									
Tracts (%)	50 (0.94)	233 (4.38)	327 (6.15)	**4,286** (80.64)	19 (0.36)	22 (0.41)	378 (7.11)	5,315 (100)	80.64
White/aging									
Tracts (%)	231 (8.75)	302 (11.44)	152 (5.76)	19 (0.72)	**1,835** (69.53)	45 (1.71)	55 (2.08)	2,639 (100)	69.53
Elite									
Tracts (%)	190 (2.96)	481 (7.49)	314 (4.89)	37 (0.58)	40 (0.62)	**5,218** (81.23)	144 (2.24)	6,424 (100)	81.23
Immigrants									
Tracts (%)	92 (1.67)	78 (1.41)	416 (7.54)	133 (2.41)	20 (0.36)	82 (1.49)	**4,698** (85.12)	5,519 (100)	85.12
Total	8,288	19,993	7,052	5,991	2,317	6,992	7,718	58,351	

Note: Values in bold represent the neighborhoods that remained stable.

exhibits various trajectories. The dominant patterns do not always conform to classical models of neighborhood change, providing counterpoints to some long-established assumptions.

Neighborhood stability. The last column of Table 9 shows that the tendency of neighborhoods to remain in the same cluster is particularly pronounced along the two extremes: the *immigrant* and *black/poor* neighborhoods on one extreme, and the *elite* neighborhoods on the other. Compared with the two extremes, the *middle-class* neighborhoods were the least likely to remain the same over time, with more than 47% of them transitioning out of that category in either 2000 or 2010. This finding is consistent with some studies that examined the neighborhoods that remained stable during a certain period of time. Morenoff and Tienda (1997) found that the ghetto underclass and gentrified neighborhoods in Chicago were more stable and experienced less transition than other types of neighborhoods. As Galster, Cutsinger, and Lim (2007) have pointed out the neighborhood change that has been observed in history may simply be an exception.

Neighborhood succession. Despite the stability of most neighborhoods, other neighborhoods have changed their attributes in the past two decades. The *middle-class* and *elite* neighborhoods have been dominated primarily by downward movements. More than 20.7% of *middle-class* neighborhoods have changed to *white/lower* neighborhoods. Some neighborhoods, first developed for the *elites*, became either *middle-class* or *white/lower* neighborhoods over time. The Midwest and Northeast regions have undergone downward movements that are considerably higher than the national average. These neighborhoods were highly concentrated in the rustbelt areas, such as New York, Chicago, and Detroit, where these once-prosperous metropolitan areas have been affected by deindustrialization.

Other types of neighborhood succession include the changes from *middle-class* and *elite* to *white/aging* and *mix/renter* neighborhoods. This study shows that most neighborhoods that shifted from *middle-class* and *elite* to *white/aging* neighborhoods are located in Miami, Tampa, Phoenix, Tucson, and New York. In addition, more than 75% of the changes from *middle-class* to *mix/renter* neighborhoods are found in the South and West such as the metropolitan areas of Las Vegas, Sacramento, Dallas, and Phoenix. Another 16.5% of these changes are located in the Midwest such as in Chicago. In contrast to the transitions from *middle-class* to *mix/renter*, most of the changes from *elite* to *mix/renter* neighborhoods are found in the Northeast and West regions. They were predominantly located in large metropolitan areas such as New York, Los Angeles, Boston, and San Francisco.

Most types of the neighborhood successions listed above confirm the classic theories of neighborhood change, in which the socioeconomic status of inhabitants becomes successively lower (Liu 1997). However, many of the downgrading movements skip the stages of relatively lower socioeconomic status by switching directly to the later stages of the neighborhood life cycle, stages that are dominated by underclass neighborhoods. For example, about 2.4% of *middle-class* neighborhoods changed directly into *black/poor* neighborhoods, which were predominantly located in the South. Most of these changes were in the suburbs of Atlanta, Memphis, and Washington, D.C. The concentration of a large black population in East Washington, D.C. (Knox 1987) and the emergence of black suburbs around Washington, D.C. (Vicino, Hanlon, and Short 2007) have been identified in the literature. In this study, we found that except for the stable *black/poor* neighborhoods, two-thirds of the other *black/poor* neighborhoods in Washington, D.C., were changed from either *middle-class* or *elite* neighborhoods (the other one-third is *from mix/renter*). These changes varied in other metropolitan areas; most of the *black/poor* neighborhoods were changed from *middle-class* in Atlanta, and from *mix/renter* and *elite* in New York. Furthermore, the downward movements from *middle-class* or *elite* to *immigrant* neighborhoods are located mostly in the established and emerging immigration gateways (Painter and Yu 2008) such as New York, Miami, Dallas, Washington, D.C., Los Angeles, Phoenix, or San Diego.

Examining new construction over the past two decades may help place these trends of downgrading in context. From 1990 to 2010, the overwhelming majority of new housing units (about 70%) were located in the South and West, with development in the Midwest and Northeast lagging behind. Most of the metropolitan areas that have witnessed dramatic downward movements from higher-income to *mix/renter, white/aging, black/poor*, or *immigrant* neighborhoods gained a large number of new residential constructions during the period under study. Downgrading movements are possible when new housing units on the periphery of cities attract the higher-income population, which creates new housing opportunities in the urban core, as well as in the suburban areas (Price-Spratlen and Guest 2002). The higher number of new housing units in those metropolitan areas explains these downgrading trends to a certain extent.

Neighborhood upgrading. The past two decades have witnessed dramatic neighborhood stability and succession to a lesser extent. However, there still has a trend of "neighborhood upgrading." *White/lower* neighborhoods, in particular, are more likely to attract higher-income households to a certain critical point to upgrade into *middle-class* neighborhoods. This kind of change is mostly located in the South and Midwest such as in Atlanta, Charlotte, Chicago, and St. Louis, as well as in some of the large metropolitan areas of the Northeast and West such as Philadelphia and Portland. These large metropolitan areas provide more opportunities for the *middle-class* to upgrade into *elite* neighborhoods. *Mix/renter* and *white/aging* neighborhoods, mostly located in the South, have moved upward either to *middle-class* or *elite* neighborhoods.

Upgrading did occur among most types of neighborhoods, but the upward social ladder seems to become steeper for households in the underclass: *black/poor* and *immigrant* neighborhoods. However, small segments of some big metropolitan areas have seen upgrading for the underclass neighborhoods, especially in central cities. In particular, underclass neighborhoods upgrading into *middle-class* or *elite* neighborhoods are more often found in large metropolitan areas such as New York, San Diego, Chicago, San Francisco, Los Angeles, and Atlanta. According to the U.S. Environmental Protection Agency (U.S. EPA 2010), the share of new residential construction in central cities and old suburbs has increased strikingly in those metropolitan areas. This trend toward more redevelopment in central cities and old suburbs may suggest heavy investment in those areas. In this situation, some underclass residential districts, as well as some *white/lower, mix/renter*, and *white/aging* neighborhoods, may remain, and have attracted gentrifiers in significant numbers, while others may have been razed, a block at a time, to provide single-family homes, townhomes, or condominiums for upper-income households. Both scenarios may result in the neighborhood upgrading in the central cities and old suburbs of those metropolitan areas.

Toward a diversity of neighborhood change. There are many neighborhood changes that do not fall into the categories of neighborhood stability, succession, and upgrading. Before jumping to the task of analyzing other neighborhood changes, the magnitude of the underlying changes that accompany categorical shifts is examined. By investigating the changes in *z*-score means, we found that most neighborhoods were undergoing significant and dramatic changes in at least one key indicator, and small to modest changes in other indicators, which barely pushed them over the border from one category to another.

Many changes do not fall into the categories of neighborhood stability, succession, and upgrading. For example, some *black/poor* neighborhoods are more likely to change into *immigrant* neighborhoods, and many *immigrant* neighborhoods into *black/poor*. The mutual transitions among underclass neighborhoods with similar social status can be identified as the "neighborhood transition trap," which is similar to the "poverty cycle" of families or "development trap" of countries in economics (Collier 2007).

Other examples may include the changes between *white/lower* and *white/aging*, or between *mix/renter* and *immigrant* neighborhoods. *White/aging* neighborhoods generally emerge from neighborhoods that were previously *white/lower*. More than half of these changes are located in Sunbelt metropolitan areas in Florida, Arizona, South Carolina, North Carolina, and so on. According to the U.S. Census Bureau, the states of California, Florida, New York, and Texas have attracted large elderly populations in recent decades. The older population is growing most rapidly in the West such as in the state of Arizona. Not surprisingly, neighborhoods in these states have changed more rapidly to *white/aging*. As this study does not follow movers, these changes could be due to the influx of residents with entirely different socioeconomic attributes, or could be the result of "aging in place" (Fitzpatrick and Logan 1985; Frey 2006; Lagory, Ward, and Juravich 1980). No matter what the situation, an increased number of seniors may result in considerable changes to the age structure, family composition, educational attainment, vacancy rate, or unemployment rate of the neighborhood. Although these kinds of changes only have a minor impact on the average household/family income in the neighborhoods, they may have substantially different repercussions for local services and facilities.

The mutual transitions among neighborhoods with similar household income also exist between *immigrant* and *mix/renter* neighborhoods. Most of the shifts between these two classifications are located in immigrant gateways and big metropolitan areas, especially in the West. However, central cities differ from suburbs in the patterns of these changes. Specifically, changes from *mix/renter* to *immigrant* neighborhoods occurred equally in central cities and suburbs. However, neighborhoods that changed from *immigrant* to *mix/renter* are located predominantly in central cities (more than 86%). The city/suburb difference in the transition patterns between *immigrant* and *mix/renter* neighborhoods is consistent with the findings that traditional influx patterns of immigration have changed as suburbs became the new destination of immigrants who bypass the cities and settled directly in the suburbs (Hanlon, Short, and Vicino 2010). In contrast, *mix/renters* are more likely to make their homes in central cities than *immigrants*. Generally speaking, both clusters share similar features in many indicators, especially in housing characteristics and household income, but demographic compositions, educational attainment, and unemployment rates differ widely, and these changes may challenge the existing policies or services in these communities. In sum, neighborhoods may experience remarkable changes in some attributes, but a minor change in a single variable. Therefore, neighborhood change could be more complicated and exhibit various trajectories.

Discussions and Conclusions

Using the pooled tract-level data from 1990 to 2010, this research describes the typologies and trajectories of neighborhood transition in U.S. metropolitan areas. Most importantly, this study reveals the diversity of neighborhood change by identifying a total of 280 actual sequences and 49 types of neighborhood change for the past two decades. The polarization and the specifics of neighborhood sequences/transitions are crucial to the study of neighborhood change. Neighborhood change is not always a simple transition along a single indicator, nor is it always a predictable transition along a downward succession or upgrading to a lesser extent. It is complicated and may include various transitions and trajectories. Although transformations that overcome wide gaps in race and income seem very difficult, all 49 types of changes do occur in metropolitan America to a certain extent. Understanding those changes that do not fall under the frame of either downgrading or upgrading is very important for policy makers and practitioners in providing appropriate local services, support, or opportunities for the residents. The trajectories and sequences of neighborhood change in this study reinforce some findings from prior research, and also offer some new insights into the patterns of neighborhood change. Specifically, this study makes several contributions to the existing literature and to our understanding of neighborhood change.

First, the visualization technique of the clustergram is used to identify the best cluster choice. An important aspect of cluster analysis is cluster stability.[1] Usually, the same data set may yield different cluster results when acted upon by different clustering algorithms. Some cluster results may be very stable and some may not. Nevertheless, the issue of cluster stability is generally ignored in the studies of neighborhood typologies. Based on the stability of cluster formation and other statistical tests, an intuitive and reliable set of seven neighborhood typologies in the United States has been identified. The profiles of these seven clusters largely echo and also extend the findings of the existing literature on social class (Beeghley 2004; Gilbert 1998; Thompson and Hickey 2005) and neighborhood typologies.

Second, this study investigates multidimensional neighborhood typologies using national data. This analysis at the national level captures the full landscape of neighborhood change in metropolitan America, which provides a chance to test classic theories decades ago and to reveal the realities of neighborhood change in the past two decades. In addition, explanations and interpretations of neighborhood change only concerning a single indicator are not sufficient, as they explain only one aspect of this process. If a single indicator is the only criteria we use to assess neighborhood transition, neighborhood changes that are not necessarily associated with changes in that indicator will be ignored. Thus, a multidimensional approach and the use of national data are important in identifying the diversity of neighborhood change.

By examining the trajectories of multidimensional neighborhood change, this research reveals the trends of shrinking *middle-class* neighborhoods and the polarization of inequality in neighborhood distributions. Most *middle-class* neighborhoods are gradually either sinking to *white/lower* groups or rising into *elite* enclaves. The result of these transformations is the polarization of neighborhood inequality at both extremes of the social stratum. This confirms that the middle-class has shrunk dramatically in metropolitan areas and in the suburbs (Swanstrom et al. 2004) and the fact that there is a growing income inequality in metropolitan America (Booza, Cutsinger, and Galster 2006; Swanstrom et al. 2004).

Broadly speaking, downward changes are usually interpreted under the general rubric of traditional models of neighborhood change. The findings in this study, however, reveal the primarily stable nature of neighborhoods during the study period. Neighborhoods tend to remain stable for at least two successive census years when passing through their life cycles. The higher stability of underclass neighborhoods reflects the enduring concentration of poverty and racial minorities in metropolitan areas (Megbolugbe, Hoek-Smit, and Linneman 1996; Quercia and Galster 2000). Today, large differences among racial and ethnic minorities continue to exist in many areas (Blank, Dabady, and Citro 2004). Discrimination in the housing market or exclusionary zoning may still play a significant role in the enduring *black/poor* neighborhoods (Price-Spratlen and Guest 2002). Furthermore, once an immigration gateway is established, that area will continue to attract higher proportions of immigrants (Frey 1995), although a large number of immigrants gravitate to new areas (Painter and Yu 2008). Factors such as the effect of pioneer immigration, chain immigration, and family building (Frey 1995; Simpson, Gavalas, and Finney 2008) may lead to high stability of *immigrant* neighborhoods. The high stability of *elite* neighborhoods could be due to the higher-status households' security and satisfaction with their homes and neighborhoods (Coulton, Theodos, and Turner 2009). It may also reflect the "enchanting spaces" created by American intellectuals and design professionals (Knox 2008).

Despite the relative stability of neighborhoods, the past two decades have witnessed a somewhat dramatic neighborhood succession. In the traditional neighborhood life-cycle model or filtering model, neighborhood changes move along a predictable downward succession. This study, however, demonstrates that the socioeconomic status of inhabitants in a neighborhood does not necessarily become successively lower. Many of the downgrading movements skip the stages of the next lower socioeconomic status by switching directly to the later stages of the neighborhood life cycle, stages that are dominated by underclass neighborhoods. However, it could be possible that neighborhoods quickly change into the next stage in only a few years before finally switching to underclass neighborhoods, a shift that cannot be identified by the census data. This suggests that the neighborhood life cycle could be decades long or last only for a few years. With the data at hand, it is difficult to investigate the length of neighborhood life cycle, or to examine whether neighborhood change follows a predictable downward succession. These questions might be explicitly considered in future research.

There was, in fact, a substantial countertrend toward neighborhood upgrading, and the changes tended to follow a cluster-specific pattern. For instance, moving up the social ladder was difficult for underclass neighborhoods, but small segments of the central cities of some big metropolitan areas displayed this change. The upgrading change, from lower-class to upper-class neighborhoods, may reflect the notion of the third and fourth wave of gentrification identified by Lees, Slater, and Wyly (2008), a change that is characterized by large-scale capital and the collaboration of government and private sectors.

Finally, the same type of neighborhoods in different regions may experience substantially different outcomes, which may strongly correlate to the social, economic, and cultural contexts of regions. Neighborhood typologies do not occur with equal likelihood throughout every region, which portends a pattern of uneven distribution in the trajectories of neighborhood change. It is hardly a novel observation that the studies of neighborhood change need to take into account regional differences. However, this has received surprisingly little attention in the literature on neighborhood change. Due to the resolution problem, maps of neighborhood distribution and the patterns of transition at the national level do not show well in this article. In the next paper on which we are working, more detailed spatial issues will be explored by investigating a specific metropolitan area in the United States. Some factors, such as federal policy, investment climate, racial/ethnic discrimination, exclusionary zoning, economic recessions, residential mortgage foreclosures, or emerging new gateways, may also play significant roles in explaining the patterns of neighborhood changes. However, evaluating the total 49 types of neighborhood changes based on all the census tracts in the United States may provide less detail than could be achieved by studying a single area. Within the limited space of this article and with the data at hand, it is difficult to investigate the roles played by various forces on the total 49 types of neighborhood changes using statistic models such as logistic regression models. One of the most pressing questions to address in the future work would be to focus on a certain type of neighborhood change within single jurisdictions and to answer more precise questions such as how different forces and regional differences may determine the directions that neighborhood trajectories will take, and to what extent these neighborhoods will change.

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Note

1. Cluster stability is different from neighborhood stability.

References

Beeghley, Leonard. 2004. *The Structure of Social Stratification in the United States*. New York: Pearson.

Bench, Katie. 2003. "Comparing Quality Measures: The American Community Survey's Three-Year Averages and Census 2000's Long Form Sample Estimates." Planning, Research, and Evaluation Division, American Community Survey, December 17. http://www.census.gov/acs/www/Downloads/library/2003/2003_Bench_01.pdf (accessed September 28, 2013).

Bier, Thomas. 2001. "Moving Up, Filtering Down: Metropolitan Housing Dynamics and Public Policy." A Discussion Paper Prepared for the Brookings Institution, Washington, DC.

Birch, David L. 1971. "Toward a Stage Theory of Urban Growth." *Journal of American Institute of Planners* 37 (2): 78–87.

Blank, Rebecca M., Marilyn Dabady, and Constance F. Citro. 2004. *Measuring Racial Discrimination*. Washington, DC: National Academies Press.

Booza, Jason C., Jackie Cutsinger, and George Galster. 2006. *Where Did They Go? The Decline of Middle-Income Neighborhoods in Metropolitan America* (Living Cities Census Series). Washington, DC: Metropolitan Policy Program, The Brookings Institution.

Burgess, Ernest Watson. 1925. "The Growth of the City: An Introduction to a Research Project." In *The Inner City Reader*, edited by Richard T. LeGates and Frederic Stout, 150–57. New York: Routledge.

Charles, Suzanne Lanyi. 2011. *Suburban Gentrification: Understanding the Determinants of Single-Family Residential Redevelopment, A Case Study of the Inner-Ring Suburbs of Chicago, IL, 2000–2010*. Cambridge, MA: Joint Center for Housing Studies Harvard University.

Chipmana, Jonathan, Richard Wrighta, Mark Ellis, and Steven R. Holloway. 2012. "Mapping the Evolution of Racially Mixed and Segregated Neighborhoods in Chicago." *Journal of Maps* 8 (4): 340–43.

Collier, Paul. 2007. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*. New York: Oxford Univ. Press.

Coulton, Claudia, Brett Theodos, and Margery A. Turner. 2009. *Family Mobility and Neighborhood Change*. Washington, DC: The Urban Institute.

Denton, Nancy A., and Douglas S. Massey. 1991. "Patterns of Neighborhood Transition in a Multiethnic World: U.S. Metropolitan Areas, 1970–1980." *Demography* 28 (1): 41–63.

Downs, Anthony. 1981. *Neighborhoods and Urban Development*. Washington, DC: The Brookings Institution.

Fitzpatrick, Kevin M., and John R. Logan. 1985. "The Aging of the Suburbs, 1960–1980." *American Sociological Review* 50 (1): 106–17.

Fong, Eric, and Kumiko Shibuya. 2003. "Economic Changes in Canadian Neighborhoods." *Population Research and Policy Review* 22:147–70.

Freeman, Lance. 2005. "Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods." *Urban Affairs Review* 40 (4): 463–91.

Frey, William H. 1995. "Immigration and Internal Migration 'Flight' from US Metropolitan Areas: Toward a New Demographic Balkanisation." *Urban Studies* 32:733–57.

Frey, William H. 2006. *America's Regional Demographics in the'00s Decade: The Role of Seniors, Boomers and New Minorities*. Washington, DC: The Brookings Institution.

Galster, George. 2001. "On the Nature of Neighbourhood." *Urban Studies* 38 (12): 2111–24.

Galster, George, Jackie Cutsinger, and Up Lim. 2007. "Are Neighbourhoods Self-Stabilising? Exploring Endogenous Dynamics." *Urban Studies* 44 (1): 167–85.

Galster, George C., Roberto G. Quercia, Alvaro Cortes, and Ron Malega. 2003. "The Fortunes of Poor Neighborhoods." *Urban Affairs Review* 39 (2): 205–27.

Gilbert, Dennis. 1998. *The American Class Structure*. New York: Wadsworth.

Hanlon, Bernadette. 2009. "A Typology of Inner-Ring Suburbs: Class, Race, and Ethnicity in U.S. Suburbia." *City & Community* 8 (3): 221–46.

Hanlon, Bernadette, John Rennie Short, and Thomas J. Vicino. 2010. *Cities and Suburbs: New Metropolitan Realities in the US*. London: Routledge.

Hanlon, Bernadette, Thomas Vicino, and John Rennie Short. 2006. "The New Metropolitan Reality in the US: Rethinking the Traditional Model." *Urban Studies* 43 (12): 2129–43.

Henning, Christian, and Norbert Christlieb. 2002. "Validating Visual Clusters in Large Datasets: Fixed-Point Clusters of Spectral Features." *Computational Statistics & Data Analysis* 40 (4): 723–39.

Hill, Edward W., John F. Brennan, and Harold L. Wolman. 1998. "What Is a Central City in the United States? Applying a Statistical Technique for Developing Taxonomies." *Urban Studies* 35 (11): 1935–69.

Hoover, Edgar M., and Raymond Vernon. 1959. *Anatomy of a Metropolis*. Cambridge, MA: Harvard Univ. Press.

Hoyt, Homer. 1939. *The Structure and Growth of Residential Neighborhoods in American Cities*. Washington, DC: Federal Housing Administration.

Hudson, James R. 1980. "Revitalization of Inner-City Neighborhoods: An Ecological Approach." *Urban Affairs Review* 15 (4): 397–408.

Johnson, Dallas E. 1998. *Applied Multivariate Methods for Data Analysts*. Pacific Grove, CA: Duxbury Press.

Kitchen, Peter, and Allison Williams. 2009. "Measuring Neighborhood Social Change in Saskatoon, Canada: A Geographic Analysis." *Urban Geography* 30 (3): 261–88.

Knox, Paul L. 1987. "City Profile: The Washington Metropolitan Area." *Cities* 4 (4): 290–98.

Knox, Paul L. 2008. *Metroburbia, USA*. New Brunswick: Rutgers Univ. Press.

Lagory, Mark, Russell Ward, and Thomas Juravich. 1980. "The Age Segregation Process: Explanation for American Cities." *Urban Affairs Review* 16 (1): 59–80.

Lees, Loretta, Tom Slater, and Elvin K. Wyly. 2008. *Gentrification*. New York: Routledge.

Ley, David, and Cory Dobson. 2008. "Are There Limits to Gentrification? The Contexts of Impeded Gentrification in Vancouver." *Urban Studies* 45 (12): 2471–98.

Li, Yanmei, and Hazel A. Morrow-Jones. 2010. "The Impact of Residential Mortgage Foreclosure on Neighborhood Change and Succession." *Journal of Planning Education and Research* 30 (1): 22–39.

Liu, Feng. 1997. "Dynamics and Causation of Environmental Equity, Locally Unwanted Land Uses, and Neighborhood Changes." *Environmental Management* 21 (5): 643–56.

Megbolugbe, Isaac F., Marja C. Hoek-Smit, and Peter D. Linneman. 1996. "Understanding Neighbourhood Dynamics: A Review of the Contributions of William G. Grigsby." *Urban Studies* 33 (10): 1779–95.

Mikelbank, Brian A. 2004. "A Typology of U.S. Suburban Places." *Housing Policy Debate* 15 (4): 935–64.

Mikelbank, Brian A. 2006. "Local Growth Suburbs: Investigating Change within the Metropolitan Context." *Opolis* 2 (1): 1–15.

Mikelbank, Brian A. 2011. "Neighborhood Déjà Vu: Classification in Metropolitan Cleveland, 1970–2000." *Urban Geography* 32 (3): 317–33.

Morenoff, Jeffrey D., and Marta Tienda. 1997. "Underclass Neighborhoods in Temporal and Ecological Perspective." *The ANNALS of the American Academy of Political and Social Science* 551 (1): 59–72.

Morrow-Jones, Hazel, and Mary Wenning. 2005. "The Housing Ladder, the Housing Life-Cycle and the Housing Life-Course: Upward and Downward Movement among Repeat Home-Buyers in a US Metropolitan Housing Market." *Urban Studies* 42 (10): 1739–54.

Newman, Kathe, and Philip Ashton. 2004. "Neoliberal Urban Policy and New Paths of Neighborhood Change in the American Inner City." *Environment and Planning A* 36:1151–72.

Orfield, Myron. 2002. *American Metropolitics: The New Suburban Reality*. Washington, DC: Brookings Institution Press.

Painter, Gary, and Zhou Yu. 2008. "Leaving Gateway Metropolitan Areas in the United States: Immigrants and the Housing Market." *Urban Studies* 45 (5–6): 1163–91.

Price-Spratlen, Townsand, and Avery M. Guest. 2002. "Race and Population Change: A Longitudinal Look at Cleveland Neighborhoods." *Sociological Forum* 17 (1): 105–36.

Quercia, Roberto G., and George C. Galster. 2000. "Threshold Effects and Neighborhood Change." *Journal of Planning Education and Research* 20: 146–62.

Schonlau, Matthias. 2004. "Visualizing Hierarchical and Non-hierarchical Cluster Analyses with Clustergram." *Computational Statistics* 19 (1): 95–111.

Schwab, William A. 1987. "The Predictive Value of Three Ecological Models: A Test of the Life-Cycle, Arbitrage, and Composition Models of Neighborhood Change." *Urban Affairs Quarterly* 23 (2): 295–308.

Schwirian, Kent P. 1983. "Models of Neighborhood Change." *Annual Review of Sociology* 9:83–102.

Séguin, Anne-Marie, Philippe Apparicio, and Mylène Riva. 2012. "Identifying, Mapping and Modelling Trajectories of Poverty at the Neighbourhood Level: The Case of Montréal, 1986–2006." *Applied Geography* 35:265–74.

Shevky, Eshref, and Wendell Bell. 1955. *Social Area Analysis: Theory, Illustrative Applications and Computational Procedure*. Stanford: Stanford Univ. Press.

Simpson, Ludi, Vasilis Gavalas, and Nissa Finney. 2008. "Population Dynamics in Ethnically Diverse Towns: The Long-Term Implications of Immigration." *Urban Studies* 45 (1): 163–83.

Stevens, James P. 2001. *Applied Multivariate Statistics for the Social Sciences*. Mahwah: Lawrence Erlbaum.

Swanstrom, Todd, Colleen Casey, Robert Flack, and Peter Dreier. 2004. *Pulling Apart: Economic Segregation Among Suburbs and Central Cities in Major Metropolitan Areas* (Metropolitan Policy Program). Washington, DC: The Brookings Institution.

Thompson, William, and Joseph Hickey. 2005. *Society in Focus*. Boston: Pearson.
U.S. Environmental Protection Agency. 2010. "Residential Construction Trends in America's Metropolitan Regions." http://www.epa.gov/smartgrowth/pdf/metro_res_const_trends_10.pdf (accessed September 28, 2013).
Vicino, Thomas J. 2008. "The Spatial Transformation of First-Tier Suburbs, 1970 to 2000: The Case of Metropolitan Baltimore." *Housing Policy Debate* 19 (3): 479–518.
Vicino, Thomas J., Bernadette Hanlon, and John Rennie Short. 2007. "Megalopolis 50 Years On: The Transformation of a Globalizing City Region." *International Journal of Urban and Regional Research* 31 (2): 344–67.
Vickers, Dan, and Phil Rees. 2007. "Creating the UK National Statistics 2001 Output Area Classification." *Royal Statistical Society* 170 (2): 379–403.

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