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PATTERNS OF NEIGHBORHOOD RACIAL AND ETHNIC CHANGE IN MULTIETHNIC METROS, 1970-2010 *

Michael D.M. Bader
Department of Sociology and Center on Health, Risk and Society
American University

Siri Warkentien
Department of Sociology
Johns Hopkins University

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*Corresponding author: Michael D. M. Bader, American University Department of Sociology, Battelle-Thompkins T-15, 4400 Massachusetts Ave. NW, Washington, D.C. 20016; bader@american.edu; (202)-885-2433.

Acknowledgements go here.

ABSTRACT

Racial residential segregation persists in most American metropolitan areas even as evidence suggests that the primary model to explain neighborhood racial and ethnic change – the invasion/succession model – no longer applies. We show how contemporary evidence of residential behaviors contracts assumptions of the invasion/succession model and demonstrate how this contemporary evidence would suggest a much slower pace of change. We examine how well models apply to empirical patterns of neighborhood racial and ethnic change, identified using growth mixture models, from 1970 to 2010 in the metropolitan areas surrounding the four largest U.S. cities: New York, Los Angeles, Chicago, and Houston. We investigate the distribution of types of neighborhood/racial ethnic change over the four metropolitan areas, map the ecological context of trajectories, and model the neighborhood characteristics associated with different types of change.

Racial residential segregation continues to shape opportunities in most American metropolitan areas (Massey and Denton 1993; Collins and Williams 1999; Sampson 2008). In the post-Civil Rights era, there is growing acknowledgement that the pervasive model of neighborhood racial and ethnic change that leads to segregation, “invasion/succession” and white flight, explains very little of the persistent patterns of segregation (Taub, Taylor, and Dunham 1984; Logan and Zhang 2010). In this context, models of neighborhood change emerging in increasingly diverse multiethnic metropolitan areas must be developed in order to understand contemporary patterns of racial and ethnic segregation.

Logan and Zhang (2010) make the best argument against the continued usefulness of the invasion/succession model of neighborhood change. They do so by following neighborhood racial and ethnic transitions over three successive decennial censuses, representing two decades of change. Their evidence demonstrates very few neighborhoods transition from being all-white to being all-minority as the invasion/succession model would predict. Instead, they argue that “incremental additions” of minorities to all-white neighborhoods change the composition from all-white to stable, multiethnically integrated “global neighborhoods.”

Despite its improvement, we argue that Logan and Zhang’s (2010) contribution to understanding how patterns of neighborhood change relate to metropolitan segregation is limited in three ways. First, despite using terms like “incremental addition” and discussing slow patterns of racial and ethnic change, their methods do not actually measure the *pace* of neighborhood change. This results from the fact that they rely on transition matrices that measure neighborhood change as a categorical change between two stable categories of neighborhood racial and ethnic composition. The processes that they describe are as likely to occur within these broad categories as across them. Second, they fail to systematically hypothesize the potential mechanisms that contribute to different patterns of neighborhood change, a problem we think results because their data limited them to investigating transitions. Third, and by their own admission, they do not consider the ecological context of neighborhood change that could inform how processes emerge to create segregation.

In this paper, we build on previous research that argues that researchers should examine the pace of neighborhood racial and ethnic change in the post-Civil Rights era (Bader 2012). This research shows how contemporary evidence of individual processes violates the assumption of the invasion/succession model and justifies using a new method, growth mixture models, for studying patterns of neighborhood racial and ethnic change. This research, however, examines a single metropolitan area that limits the geographic generalizability of its findings. We apply the same model and methods to examine patterns of neighborhood racial and ethnic change in the metropolitan areas surrounding the four largest cities in the United States: New York, Los Angeles, Chicago, and Houston. The variation of both urban development and experiences with multiethnic population growth in these four cities provide ample opportunities to understand metropolitan variation in the paths of neighborhood racial and ethnic change.

BACKGROUND

The invasion/succession model describes a process where a small number of blacks enter – or "invade" – a neighborhood. Whites attempt to resist this "invasion" and, failing to do so, flee the neighborhood leaving their houses vacant (Duncan and Duncan 1957). Given whites' aversion to living among black neighbors, black families move into their vacant houses and further increase the percentage of black residents in the neighborhood and triggering more whites (even those more tolerant than initial movers) to flee. This process leads to the rapid "succession" of neighborhoods from being all-white neighborhoods to all-black (Karl E Taeuber and Alma F Taeuber 1965; Lee and Wood 1990, 1991).

Demographic and sociological research finds a substantial amount of evidence in favor of this model through the 1970s. Evidence from recent census, however, challenges the invasion/succession model, most notably Logan and Zhang's (2010) analysis incorporating multiple decades of neighborhood racial and ethnic change. Given this evidence, it is worth evaluating the assumptions of the model in order to identify where it falls short and help us develop new models to explain contemporary patterns neighborhood racial and ethnic change.

Schelling's model and assumptions

The first assumption of Schelling's model is that the world consists entirely of blacks and whites. The growing multiethnic diversity in American metropolitan areas as a result of 1965 immigration reform clearly violates this assumption of the model (Waldinger 1989). This diversity increases the complexity of research because researchers must now account for variations across three or four groups rather than between just two (Zubrinsky and Bobo 1996). Using a very basic categorization of neighborhoods with only a single measure of integration, moving from two groups to three groups increases the number of neighborhood types from three (e.g., all-white, all-black, integrated white-black) to seven (e.g., all-white, all-black, all-Latino, white/black, white/Latino, black/Latino, integrated white/black/Latino). Four groups leads to 15 categories of racial composition.

While this diversity violates the technical assumptions of the invasion/succession model, the model could be generalized to include multiple group comparisons. This would be the case if we saw "invasion" where another racial or ethnic group resides by a racial or ethnic group of a neighborhood and a rapid succession to being entirely composed of the latter. In its ideal form, we would see the rapid segregation of the metropolitan area into neighborhoods composed entirely of residents of one racial or ethnic group. Given that transitions occur at a different pace depending on the racial and ethnic group suggests that different factors might contribute to neighborhood change depending on the groups involved.

Racial and ethnic residential preferences

That the pace of neighborhood racial or ethnic transition varies by the racial and ethnic group leads to the second assumption of the model: that racial preferences guide neighborhood change. We do not argue that this assumption is violated, but must be specified for each of the relationships between racial and ethnic groups. In other words, the preference of whites to live among blacks, Latinos, and Asians must be specified; the preference of blacks to live among whites, Latinos, and Asians; and so on.

Each racial and ethnic group most prefers its own members (Clark 1993). Evidence suggests, however, a racial hierarchy among remaining that places whites as the most preferred, then Asians and

Latinos, with blacks last (Zubrinsky and Bobo 1996; Charles 2000). This would suggest that neighborhoods with higher proportions of whites will be most desirable for almost all residents in the metropolitan area and therefore the least likely to remain residentially segregated if vacancies become available (see also Krysan and Farley 2002; Krysan and Bader 2007). Conversely, neighborhoods with high proportions of black residents will be the least likely to receive members from other racial and ethnic groups and therefore become more isolated. Existing evidence already provides evidence that this is the case (e.g., Logan and Zhang 2010; Swaroop 2005; Bader 2009). Since Schelling's (1971) results suggest that even very small differences in preferences lead to segregation, we would expect all racial or groups to reach a tipping point and re-segregate.

Neighborhood immigration versus emigration

It is the third assumption of the invasion/succession model that most reveals the importance of studying the pace of neighborhood change. Recall that the third assumption states that racial preferences affect both one's desire to *move out* of the neighborhood as much as one's desire to *move into* the neighborhood. Research explaining the causes of residential mobility, however, suggests that racial composition affects in- versus out-migration differently. Contemporary studies find little evidence of white flight from neighborhoods with small proportions of minority residents and where researchers find an association, it is generally small relative to life-course, employment changes and other factors that influence residential mobility (Crowder 2000; Harris 1999).

That said, racial composition guides substantially guides which neighborhood a household will *move into* upon deciding to move. This is particularly true for whites since they fail to consider neighborhoods with even a small proportion of minority residents (Farley et al. 1994; Emerson, Chai, and Yancey 2001; Krysan and Michael Bader 2007; Lewis, Emerson, and Klineberg 2011). Thus, we would not expect whites to enter neighborhoods with more than a small proportion of minorities. Given the results of surveys showing a hierarchy of racial preferences cited above, we would also expect black neighborhoods to receive few non-black neighbors and Latino neighborhoods to receive some black but mostly Latino neighbors.

Taken together, these results suggest that racial succession would still occur, but that it would do so at a far slower pace. For example, although a white household leaving an integrated white-black neighborhood will be likely be replaced by a black household, white households do not move *because* of the racial composition of the neighborhood. This eliminates the feedback loop in Schelling's (1971) model that accelerates neighborhood racial and ethnic change. Ellen (2000) demonstrates that the pace of change in the preceding decade predicts faster change in the subsequent decade, a factor not included in Schelling's model but one that might serve to further reduce the pace of neighborhood racial and ethnic change.

Racial disparities in fertility and mortality

The final assumption of Schelling's (1971) model is that only residential preferences serve to create neighborhood racial and ethnic change. In particular, this model does not account for differences in fertility and mortality that might serve to perpetuate racial and ethnic change. This oversight is unsurprising for researchers using the invasion/succession model assumed rapid racial and ethnic change meaning that fertility and mortality would only minimally contribute to racial and ethnic change. If the pace of transition slows, as we suggest above, then fertility and mortality might contribute more to racial and ethnic change. White residents staying in a neighborhood will get inevitably older with the march of time, placing them every year at greater risk of dying. Because migration tends to be higher at younger ages, younger residents will replace the residents that "leave" the neighborhood through death. The risk of fertility among these residents will be higher than the older residents and, because the younger residents will likely be a minority household, the baby who "enters" the neighborhood through birth will more likely be a minority. These two factors will lead to a racial transition in the neighborhood, even absent *any* migration.

NEIGHBORHOOD CHARACTERISTICS ASSOCIATED WITH RACIAL AND ETHNIC CHANGE

While re-evaluating the assumptions of the invasion/succession model provide a rigorous way to evaluate what we suspect creates patterns of neighborhood racial and ethnic change, preferences alone cannot explain patterns of neighborhood change. We know that other factors including economics, discrimination, and ecology also influence patterns of neighborhood racial and ethnic change. Therefore, we will examine how patterns of neighborhood change that occur in each of the four metropolitan areas correlate with other conditions of the neighborhood including income, location in the metropolitan area (e.g., urban/suburban, distance to the central business district), dominant employment sector, and population.

DATA

For this manuscript, we use the Longitudinal Neighborhood Database (LTDB) created by John Logan and colleagues (2012). This database reports Census characteristics for racial and ethnic groups from 1970 to 2010 interpolated to 2010 Census boundaries that allows for comparisons of geographic units over time. We include all tracts that fall in the 2010 definition of the New York City Combined Statistical Area (CSA), Los Angeles CSA, Chicago CSA, and Houston CSA (N=10,437).

The racial and ethnic composition measure attempts to create standard definitions of racial and ethnic categories over the four decades despite changes to the manner in which the Census gathered racial and ethnic data. The Census Bureau did not start tabulating Latinos by race until 1980 meaning that counts of whites and blacks include Latinos. We used Timberlake and Iceland's (2007) strategy of apportioning Latinos to the black and white categories in 1970 based on the proportion of each race Latinos represented in 1980. Unfortunately, the LTDB does not include a count of Latinos in 1970 to uncover how to proportion residents into appropriate categories; therefore, we used the interpolation program provided by Logan and Stults that accompanies the LTDB to apportion Latinos to 2010 tract definitions.

Second, we use growth mixture modeling to identify distinct trajectories of racial/ethnic change. Our dependent variable is the proportion of white, blacks, Latinos, and Asians present in each Census tract at 5 time points – 1970, 1980, 1990, 2000, and 2010.[1] Growth mixture modeling (GMM) expands the concepts of growth curve modeling (GCM). GCM assumes that all schools belong to one distribution

[1] Note about transforming the dependent variable.

and can be characterized by the mean growth factors. Growth mixture models allow the analyst to identify unique classes of change while still allowing for error off of the identified trajectory (Kreuter and Muthén 2008). We identify the trajectories of neighborhood change based on: a) the initial racial and ethnic composition of the neighborhood in 1970, b) the pace of neighborhood racial and ethnic change from 1970 to 2010, and c) the change in pace of the neighborhood racial and ethnic change. These three components can be mapped to the a) intercept, b) linear growth term, and c) quadriatic growth term (Bader 2012).

The growth mixture model is formally presented in equation (1). The composition of racial or ethnic group r in tract j at time t, η^{r}_{tj} is predicted by a growth trajectory model. Because the proportion of group r is the expected outcome of these model, values are transformed through the link function η^{r}_{tj} = arcsin ($p^{r}_{ti}{}^{1/2}$), where p^{r}_{ti} is the proportion of people that identify as race or ethnicity r in a the tract.[2] In this model time is indexed such that time equals zero in 1970 and measures decades (i.e., t=1 in 1980, t=2 in 1990, etc.). The growth trajectory model estimates three coefficients: an intercept, β^{r}_{0j}, of the racial or ethnic group when in 1970 (i.e., when t=0); a slope, β^{r}_{1j} , representing the linear component of change in composition in one decade; and a quadratic term, β^{r}_{2j}, to measure non-linear change in each decade. A unique component to the trajectory for each decade in which the tract is observed, e_{tj} is also included in the model and is assumed to be normally distributed around a mean of zero with variance σ_j. . In the preliminary results presented here, the variances of the slopes and quadratic terms are constrained to zero to avoid non-convergence. Later analyses will explore relaxing this constraint.

$$
\begin{aligned}
\eta^{r}_{tj|c=k} &= \beta^{r}_{0kj} + \beta^{r}_{1kj}t + \beta^{r}_{2kj}t^2 + e_{tj} \\
\beta^{r}_{0kj} &= \gamma^{r}_{k0} + u_{0j} \\
\beta^{r}_{1kj} &= \gamma^{r}_{k1} + u_{1j} \\
\beta^{r}_{2kj} &= \gamma^{r}_{k2} + u_{2j}
\end{aligned} \qquad (1)
$$

[2] Because I am modeling a proportion as an outcome, the variance is determined by the mean and the transformation is required to break the dependence of the variance on the mean. Ideally, a multinomial modeling strategy would be employed in this situation; however, the computational demands of the multinomial model make it infeasible in practice. The author would like to thank Michael Elliott (personal communication) for this advice.

We will include in each model the transformed proportion of blacks, Latinos, and Asians. We do not include white because doing so would induce perfect collinearity that will make identifying the model impossible. The model will predict a set of coefficients for every class and the number of classes will be determined by minimizing the Bayesian information criterion (BIC). The BIC assesses the trade-off between increased model fit versus the complexity of adding additional parameters to the model, so the ideal number of classes can be determined by finding the model with the number of classes where the BIC is minimized. We use Mplus 6.2 to run successive models each with one additional class than the previous.

The third stage of our analysis examines associations among neighborhood characteristics and neighborhood change trajectories. Including covariates in the growth mixture model allows us to determine whether key predictor variables discriminate latent class membership.

RESULTS

In the following tables, we present the racial composition of the metropolitan areas, the proportion of tracts falling in predefined categories based on three different criteria (that used by Logan and Zhang, a 5% threshold and a 10% threshold) and transition matrices based on each of these same three criteria.

We currently have the growth mixture model, but were unable to minimize the BIC before the PAA submission deadline.

TABLES & FIGURES

Table 1. Overall racial composition by metro area, 1970-2010

	1970	1980	1990	2000	2010
Chicago					
% white	0.75	0.70	0.67	0.59	0.55
% black	0.17	0.20	0.19	0.19	0.18
% Hispanic	0.05	0.08	0.11	0.16	0.21
% Asian	0.01	0.02	0.03	0.05	0.06
Houston					
% white	0.68	0.65	0.58	0.48	0.40
% black	0.19	0.18	0.17	0.17	0.17
% Hispanic	0.11	0.14	0.21	0.29	0.35
% Asian	0.00	0.02	0.03	0.05	0.07
Los Angeles					
% white	0.68	0.58	0.46	0.36	0.32
% black	0.09	0.10	0.09	0.08	0.07
% Hispanic	0.17	0.25	0.35	0.41	0.44
% Asian	0.03	0.06	0.10	0.13	0.16
New York					
% white	0.73	0.69	0.62	0.53	0.49
% black	0.14	0.16	0.17	0.18	0.17
% Hispanic	0.10	0.12	0.16	0.19	0.23
% Asian	0.01	0.02	0.05	0.08	0.11

Table 2A. Count of tracts by racial/ethnic composition, 1970-2010

	1970		1980		1990		2000		2010	
Racial/Ethnic Composition	N	%	N	%	N	%	N	%	N	%
A only	29	0.28	0	0	0	0	2	0.02	6	0.06
H only	3	0.03	59	0.55	174	1.63	258	2.41	304	2.85
HA	77	0.74	91	0.86	140	1.31	190	1.77	262	2.45
B only	124	1.19	413	3.88	380	3.55	435	4.06	357	3.34
BA	159	1.52	42	0.39	24	0.22	29	0.27	17	0.16
BH	178	1.7	595	5.59	882	8.24	1051	9.82	1170	10.95
BHA	505	4.83	371	3.49	442	4.13	534	4.99	623	5.83
W only	928	8.88	752	7.07	673	6.29	505	4.72	308	2.88
WA	1340	12.82	1848	17.37	1601	14.96	1286	12.01	861	8.06
WH	1052	10.06	583	5.48	515	4.81	463	4.32	468	4.38
WHA	4022	38.47	3192	30	2547	23.8	2261	21.12	2144	20.07
WB	107	1.02	104	0.98	69	0.64	63	0.59	49	0.46
WBA	260	2.49	244	2.29	223	2.08	312	2.91	257	2.41
WBH	286	2.74	364	3.42	386	3.61	421	3.93	542	5.07
WBHA	1385	13.25	1983	18.64	2647	24.73	2896	27.05	3315	31.03
Total	10455	100	10641	100	10703	100	10706	100	10683	100

NOTE: A=Asian; H=Hispanic; B=black; W=white.
A census tract is counted as containing a racial/ethnic group if the percentage of that racial/ethnic group is at least .25 times the group's overall metro percentage. For example, the Chicago metro was 55% white in 2010. Therefore, if any given census tract was (55*.25=) 13.75% or higher white, that tract was categorized as having a white presence. (See Logan & Zhang 2010 for more detail.)

Table 2B. Count of tracts by racial/ethnic composition, 1970-2010

	1970		1980		1990		2000		2010	
Racial/Ethnic Composition	N	%	N	%	N	%	N	%	N	%
A only	28	0.27	0	0	0	0	0	0	1	0.01
H only	21	0.2	42	0.39	105	0.98	192	1.79	249	2.33
HA	12	0.11	17	0.16	36	0.34	86	0.8	154	1.44
B only	284	2.72	474	4.45	422	3.94	406	3.79	301	2.82
BA	26	0.25	2	0.02	3	0.03	3	0.03	1	0.01
BH	222	2.12	447	4.2	718	6.71	896	8.37	1005	9.41
BHA	14	0.13	12	0.11	42	0.39	91	0.85	166	1.55
W only	4235	40.51	3389	31.85	2065	19.29	1099	10.27	428	4.01
WA	20	0.19	182	1.71	477	4.46	580	5.42	369	3.45
WH	3116	29.8	2497	23.47	1801	16.83	1524	14.24	1425	13.34
WHA	311	2.97	961	9.03	1985	18.55	2429	22.69	2955	27.66
WB	740	7.08	545	5.12	310	2.9	168	1.57	63	0.59
WBA	16	0.15	40	0.38	83	0.78	72	0.67	42	0.39
WBH	1285	12.29	1539	14.46	1564	14.61	1411	13.18	1414	13.24
WBHA	125	1.2	494	4.64	1092	10.2	1749	16.34	2110	19.75
Total	10455	100	10641	100	10703	100	10706	100	10683	100

NOTE: A=Asian; H=Hispanic; B=black; W=white.
A census tract is counted as containing a racial/ethnic group if that group represents at least 5% of the tract's overall population.

Table 2C. Count of tracts by racial/ethnic composition, 1970-2010

	1970		1980		1990		2000		2010	
Racial/Ethnic Composition	N	%	N	%	N	%	N	%	N	%
A only	29	0.28	1	0.01	3	0.03	3	0.03	7	0.07
H only	49	0.47	111	1.04	276	2.58	446	4.17	559	5.23
HA	10	0.1	18	0.17	70	0.65	184	1.72	302	2.83
B only	501	4.79	669	6.29	648	6.05	658	6.15	541	5.06
BA	29	0.28	7	0.07	5	0.05	5	0.05	6	0.06
BH	211	2.02	497	4.67	731	6.83	961	8.98	1111	10.4
BHA	5	0.05	9	0.08	27	0.25	93	0.87	174	1.63
W only	6067	58.03	5156	48.45	3837	35.85	2604	24.32	1695	15.87
WA	28	0.27	86	0.81	442	4.13	741	6.92	776	7.26
WH	1977	18.91	2172	20.41	2002	18.71	1880	17.56	1942	18.18
WHA	113	1.08	365	3.43	923	8.62	1330	12.42	1797	16.82
WB	760	7.27	616	5.79	461	4.31	310	2.9	175	1.64
WBA	14	0.13	15	0.14	42	0.39	82	0.77	72	0.67
WBH	629	6.02	837	7.87	949	8.87	998	9.32	1063	9.95
WBHA	33	0.32	82	0.77	287	2.68	411	3.84	463	4.33
Total	10455	100	10641	100	10703	100	10706	100	10683	100

NOTE: A=Asian; H=Hispanic; B=black; W=white.
A census tract is counted as containing a racial/ethnic group if that group represents at least 10% of the tract's overall population.

Table 3A. Matrix of transitions, 1970-2010

Race/Ethnic Category	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	Total
(1) A only	0	0	0	0	0	0	0	1	5	0	5	0	1	2	15	29
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.17	0.00	0.17	0.00	0.03	0.07	0.52	1.00
(2) H only	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	3
	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	1.00
(3) HA	0	49	14	0	0	1	3	0	0	1	2	0	0	1	5	76
	0.00	0.64	0.18	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.03	0.00	0.00	0.01	0.07	1.00
(4) B only	0	0	0	73	3	36	5	0	2	0	0	0	0	0	3	122
	0.00	0.00	0.00	0.60	0.02	0.30	0.04	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	1.00
(5) BA	0	0	0	54	1	52	17	1	2	0	7	0	3	1	20	158
	0.00	0.00	0.00	0.34	0.01	0.33	0.11	0.01	0.01	0.00	0.04	0.00	0.02	0.01	0.13	1.00
(6) BH	0	0	0	26	2	127	10	0	1	0	0	0	1	1	9	177
	0.00	0.00	0.00	0.15	0.01	0.72	0.06	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.05	1.00
(7) BHA	1	14	4	34	1	302	81	0	0	0	2	2	4	12	47	504
	0.00	0.03	0.01	0.07	0.00	0.60	0.16	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.09	1.00
(8) W only	0	8	2	11	2	15	16	90	177	88	273	4	18	24	198	926
	0.00	0.01	0.00	0.01	0.00	0.02	0.02	0.10	0.19	0.10	0.29	0.00	0.02	0.03	0.21	1.00
(9) WA	0	3	4	8	1	26	30	60	271	55	433	10	55	27	357	1340
	0.00	0.00	0.00	0.01	0.00	0.02	0.02	0.04	0.20	0.04	0.32	0.01	0.04	0.02	0.27	1.00
(10) WH	0	21	9	17	1	28	37	30	87	73	244	5	46	77	376	1051
	0.00	0.02	0.01	0.02	0.00	0.03	0.04	0.03	0.08	0.07	0.23	0.00	0.04	0.07	0.36	1.00
(11) WHA	4	179	193	35	1	159	205	27	272	136	1061	10	99	147	1490	4018
	0.00	0.04	0.05	0.01	0.00	0.04	0.05	0.01	0.07	0.03	0.26	0.00	0.02	0.04	0.37	1.00
(12) WB	0	0	0	4	0	4	3	9	5	11	7	4	0	25	35	107
	0.00	0.00	0.00	0.04	0.00	0.04	0.03	0.08	0.05	0.10	0.07	0.04	0.00	0.23	0.33	1.00
(13) WBA	0	0	0	16	2	34	15	7	12	13	21	1	8	33	95	257
	0.00	0.00	0.00	0.06	0.01	0.13	0.06	0.03	0.05	0.05	0.08	0.00	0.03	0.13	0.37	1.00
(14) WBH	0	2	1	7	0	73	18	1	4	9	19	1	4	42	105	286
	0.00	0.01	0.00	0.02	0.00	0.26	0.06	0.00	0.01	0.03	0.07	0.00	0.01	0.15	0.37	1.00
(15) WBHA	1	25	34	72	3	309	182	3	18	14	57	7	17	117	524	1383
	0.00	0.02	0.02	0.05	0.00	0.22	0.13	0.00	0.01	0.01	0.04	0.01	0.01	0.08	0.38	1.00
TOTAL	6	302	261	357	17	1166	622	229	856	400	2132	44	256	509	3280	10437
	0.00	0.03	0.03	0.03	0.00	0.11	0.06	0.02	0.08	0.04	0.20	0.00	0.02	0.05	0.31	1.00

Table 3B. Matrix of transitions, 1970-2010

Race/Ethnic Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
(1) A only	0	0	0	0	0	0	0	1	1	0	16	0	0	3	7	28
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.57	0.00	0.00	0.11	0.25	1.00
(2) H only	0	18	0	0	0	0	0	0	0	0	1	0	0	1	1	21
	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.05	1.00
(3) HA	0	6	0	0	0	0	0	0	0	0	2	0	0	2	1	11
	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.18	0.09	1.00
(4) B only	0	0	0	134	0	85	6	0	0	1	5	2	3	38	8	282
	0.00	0.00	0.00	0.48	0.00	0.30	0.02	0.00	0.00	0.00	0.02	0.01	0.01	0.13	0.03	1.00
(5) BA	0	0	0	0	0	4	1	1	1	0	13	0	0	3	2	25
	0.00	0.00	0.00	0.00	0.00	0.16	0.04	0.04	0.04	0.00	0.52	0.00	0.00	0.12	0.08	1.00
(6) BH	0	4	0	2	0	186	7	0	0	0	0	1	0	16	5	221
	0.00	0.02	0.00	0.01	0.00	0.84	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	1.00
(7) BHA	0	3	2	0	0	7	0	0	0	0	0	0	0	0	2	14
	0.00	0.21	0.14	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	1.00
(8) W only	0	5	0	37	0	67	19	331	324	837	1288	45	18	472	788	4231
	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.08	0.08	0.20	0.30	0.01	0.00	0.11	0.19	1.00
(9) WA	0	0	0	0	0	0	0	0	3	1	7	0	0	1	7	19
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.05	0.37	0.00	0.00	0.05	0.37	1.00
(10) WH	0	147	87	15	0	91	45	10	19	370	1382	2	1	278	668	3115
	0.00	0.05	0.03	0.00	0.00	0.03	0.01	0.00	0.01	0.12	0.44	0.00	0.00	0.09	0.21	1.00
(11) WHA	0	26	41	0	0	2	7	1	4	8	130	0	0	9	82	310
	0.00	0.08	0.13	0.00	0.00	0.01	0.02	0.00	0.01	0.03	0.42	0.00	0.00	0.03	0.26	1.00
(12) WB	0	0	0	78	1	119	12	16	11	58	28	7	17	228	160	735
	0.00	0.00	0.00	0.11	0.00	0.16	0.02	0.02	0.01	0.08	0.04	0.01	0.02	0.31	0.22	1.00
(13) WBA	0	0	0	0	0	3	2	0	0	0	0	0	0	1	10	16
	0.00	0.00	0.00	0.00	0.00	0.19	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.63	1.00
(14) WBH	0	33	12	35	0	426	48	3	4	40	66	4	2	304	308	1285
	0.00	0.03	0.01	0.03	0.00	0.33	0.04	0.00	0.00	0.03	0.05	0.00	0.00	0.24	0.24	1.00
(15) WBHA	1	5	11	0	0	13	19	0	0	0	13	0	1	11	50	124
	0.01	0.04	0.09	0.00	0.00	0.10	0.15	0.00	0.00	0.00	0.10	0.00	0.01	0.09	0.40	1.00
TOTAL	1	247	153	301	1	1003	166	363	367	1315	2951	61	42	1367	2099	10437
	0.00	0.02	0.01	0.03	0.00	0.10	0.02	0.03	0.04	0.13	0.28	0.01	0.00	0.13	0.20	1.00

Table 3C. Matrix of transitions, 1970-2010

Race/Ethnic Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
(1) A only	0	0	0	0	0	0	0	3	6	2	11	0	0	2	5	29
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.21	0.07	0.38	0.00	0.00	0.07	0.17	1.00
(2) H only	0	37	3	0	0	1	0	0	1	4	1	0	0	2	0	49
	0.00	0.76	0.06	0.00	0.00	0.02	0.00	0.00	0.02	0.08	0.02	0.00	0.00	0.04	0.00	1.00
(3) HA	0	4	1	0	0	0	0	0	0	1	3	0	0	0	0	9
	0.00	0.44	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.33	0.00	0.00	0.00	0.00	1.00
(4) B only	0	5	0	228	0	212	4	2	2	1	1	13	4	23	3	498
	0.00	0.01	0.00	0.46	0.00	0.43	0.01	0.00	0.00	0.00	0.00	0.03	0.01	0.05	0.01	1.00
(5) BA	0	0	0	0	0	10	1	2	2	0	11	0	0	1	1	28
	0.00	0.00	0.00	0.00	0.00	0.36	0.04	0.07	0.07	0.00	0.39	0.00	0.00	0.04	0.04	1.00
(6) BH	0	26	2	3	0	163	4	0	1	0	0	1	0	11	0	211
	0.00	0.12	0.01	0.01	0.00	0.77	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	1.00
(7) BHA	0	1	1	0	0	1	1	0	0	0	1	0	0	0	0	5
	0.00	0.20	0.20	0.00	0.00	0.20	0.20	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	1.00
(8) W only	1	77	23	135	1	165	62	1422	679	1353	1144	108	43	561	287	6061
	0.00	0.01	0.00	0.02	0.00	0.03	0.01	0.23	0.11	0.22	0.19	0.02	0.01	0.09	0.05	1.00
(9) WA	3	0	1	0	0	0	0	1	8	4	6	0	1	1	2	27
	0.11	0.00	0.04	0.00	0.00	0.00	0.00	0.04	0.30	0.15	0.22	0.00	0.04	0.04	0.07	1.00
(10) WH	2	348	209	10	1	122	36	57	48	430	532	3	5	103	69	1975
	0.00	0.18	0.11	0.01	0.00	0.06	0.02	0.03	0.02	0.22	0.27	0.00	0.00	0.05	0.03	1.00
(11) WHA	1	9	41	0	0	1	8	3	2	3	41	0	0	0	3	112
	0.01	0.08	0.37	0.00	0.00	0.01	0.07	0.03	0.02	0.03	0.37	0.00	0.00	0.00	0.03	1.00
(12) WB	0	5	0	136	3	171	18	34	14	58	15	37	18	214	34	757
	0.00	0.01	0.00	0.18	0.00	0.23	0.02	0.04	0.02	0.08	0.02	0.05	0.02	0.28	0.04	1.00
(13) WBA	0	0	0	0	1	1	3	0	2	1	1	1	0	1	3	14
	0.00	0.00	0.00	0.00	0.07	0.07	0.21	0.00	0.14	0.07	0.07	0.07	0.00	0.07	0.21	1.00
(14) WBH	0	41	9	29	0	256	30	7	9	34	26	7	1	126	54	629
	0.00	0.07	0.01	0.05	0.00	0.41	0.05	0.01	0.01	0.05	0.04	0.01	0.00	0.20	0.09	1.00
(15) WBHA	0	4	11	0	0	4	7	0	0	1	3	0	0	1	2	33
	0.00	0.12	0.33	0.00	0.00	0.12	0.21	0.00	0.00	0.03	0.09	0.00	0.00	0.03	0.06	1.00
TOTAL	7	557	301	541	6	1107	174	1531	774	1892	1796	170	72	1046	463	10437
	0.00	0.05	0.03	0.05	0.00	0.11	0.02	0.15	0.07	0.18	0.17	0.02	0.01	0.10	0.04	1.00

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