The Rise of the Bipolar[1] Neighborhood

George Galster and Jason Booza

Problem: Although planners aim to provide for income diversity in the communities they serve, too little is known about how income distributions in metropolitan neighborhoods are changing.

Purpose: We investigate whether neighborhood income diversity has increased since 1970 by examining neighborhoods in the 100 largest U.S. metropolitan areas.

Methods: We analyze neighborhoods in the 100 largest U.S. metropolitan areas from 1970 to 2000 using a combination of nominal *(H)* and ordinal *(E)* entropy indices. We focus on neighborhoods we call *bipolar*, (where $E/H > 1$), in which very low- and very high-income groups predominate. We investigate these with tract-level statistics and by using a counterfactual.

Results and conclusions: We find a dramatic increase in the number and incidence of these bipolars since 1970. Compared to other neighborhoods, we find that, on average, bipolars have significantly greater shares of very high-income families, racial diversity, shares of middle-aged persons, and shares of renters. We use a counterfactual to reveal that much of the growth in bipolars over the last three decades has been fueled by income distributions at the metropolitan scale becoming more bimodal, with fewer middle-income families. Gentrification appears to explain only a minor share of growth in bipolars.

Takeaway for practice: Metropolitan census tracts with pronounced bimodal income distributions have become more common since 1970. This appears to reflect changing metropolitan income distributions more than spatial rearrangement, although planning policies may be responsible in some instances. Whether residence in bipolar neighborhoods will benefit very low-income households by reducing stereotyping and expanding social opportunities is unclear, but such places should be monitored.

Keywords: income distribution, neighborhoods, income diversity, polarization, entropy

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In its darker past, urban planning was sometimes used as a tool to rigidly segregate different groups into distinct neighborhoods. During the last half-century, however, the tenets of urban planning have clearly evolved toward the goal of communities providing for a diversity of income (and, often, ethnic) groups in residence (Atkinson & Kintrea, 2000; Cole & Goodchild, 2001; Sarkissian, 1976). These tenets have been reflected in numerous tangible ways, from the Garden Cities/New Towns movement (Minton, 2002), to the concerns over the wholesale replacement of original residents by "gentrifiers" (Freeman, 2006; Smith, 1996), to being a key ingredient of "sustainable communities" (Tunstall, 2003). Indeed, the current AICP Code of Ethics and Professional Conduct states that "we shall seek . . . to promote . . . economic integration" (American Planning Association, 2005). This article investigates the degree to which metropolitan neighborhoods have moved toward or away from this goal since 1970, why change may have occurred, what consequences may transpire, and what implications this holds for planners.

In particular, our study employs the traditional nominal entropy *(H)* index, the newly developed ordinal entropy *(E)* index, and their ratio *(E/H)* to probe changes in the distribution of incomes within neighborhoods. We analyze census tract data for 1970–2000 in the 100 largest metropolitan areas

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in the United States in 2000. Within these tracts, which we also refer to as neighborhoods, we use six family income groups specified relative to the metropolitan median income as defined by the U.S. Department of Housing and Urban Development (HUD). We find a dramatic increase since 1970 in the number and incidence of neighborhoods we term *bipolars* because they are characterized by extremely bimodal income distributions. We identify these neighborhoods as those having *E/H* ratios greater than 1, meaning that the combination of very low-income and very high-income groups constitute a majority of the neighborhood.

Because this phenomenon has not previously been reported, we conduct an exploratory analysis designed to answer the following questions:

- What are the socioeconomic, demographic, and housing stock characteristics of these bipolars, and do they differ in these dimensions from other neighborhoods?
- In what metropolitan areas are bipolars most prevalent?
- Have bipolars arisen primarily due to changes in income distributions at the metropolitan scale or in differential sorting of income groups among neighborhoods? If the latter, what has been the role of gentrification processes?
- What social consequences does the rise of bipolars portend for disadvantaged residents of these neighborhoods?

The Literature on Neighborhood Income Diversity

There is only a modestly sized scholarly literature on the distribution of economic groups within neighborhoods.[2] These studies have found that even though there are many nearly homogeneous neighborhoods with extreme concentrations of wealth or poverty (Hardman & Ioannides, 2004a, 2004b; Jargowsky, 1997, 2003), a significant amount of income diversity is typically present within neighborhoods (Berube & Tiffany, 2004; Hardman & Ioannides, 2004a, 2004b; Immergluck & Smith, 2002; Ioannides, 2004; Ioannides & Seslen, 2002; Thomas, Schweitzer, & Darnton, 2004). Immergluck and Smith (2002) and Thomas, Schweitzer, and Darnton (2004) classified neighborhoods in Chicago and Grand Rapids, respectively, according to their internal income distributions, and then tracked neighborhoods longitudinally to assess the stability of their classifications; Berube and Tiffany (2004) and Galster, Booza, Cutsinger, Metzger, and Lim (2005) did the same for a national sample of neighborhoods. They generally found a large number of highly mixed, stable neighborhoods. Ioannides (2004) and Talen (2006) used multivariate techniques to probe the correlates of neighborhood income diversity, and found a greater likelihood of mixing in neighborhoods with more owner-occupants and non-White households, higher densities, lower vacancy rates and housing values, and greater diversity of housing by tenure and values. Galster et al. (2005) developed an econometric model of the metropolitan forces influencing the degree to which very low-income households reside in neighborhoods with great income diversity, which also demonstrates the importance of owner-occupancy rates and slack rental markets in expanding these opportunities. Booza, Cutsinger, and Galster (2006) identified a dramatic decline since 1970 in the share of neighborhoods whose median incomes would place them in the middle-income category.

But this literature has not probed the distribution of income within neighborhoods using multiple statistical measures that are comparable both across time and metropolitan areas. No studies have employed the newly developed index of ordinal entropy for this purpose. As a result, this literature has told us little about how the prevalence of particular sorts of neighborhood income profiles may have changed systematically over the last several decades, and whether these particular sorts of neighborhoods have distinctive social, demographic, or housing profiles. Finally, it provides few hints about the degree to which any changes in income distributions within neighborhoods are primarily driven by changes in income distributions at the metropolitan scale or by new patterns of spatial sorting among households. It is these gaps that our study seeks to fill. By doing so, we believe that we not only make methodological advances in the analysis of neighborhood income distributions, but also reveal a previously unnoticed trend with potentially important implications.

Data and Measures

Spatial Units of Analysis and Data Sources

Our primary spatial units of analysis are the Metropolitan Statistical Areas (MSAs) and Primary Metropolitan Statistical Areas (PMSAs) making up the 100 largest metropolitan areas in the nation according to the 2000 Census. These areas account for 61.4% (173 million) of the total U.S. population in 2000.

Metropolitan area boundaries often change over time, and we felt that specifying a constant definition across our 30-year timeframe would be artificial and inappropriate.[3] Instead, we chose to use the boundaries defined for the year in which particular data were measured. This means that, as is widely accepted (Abramson, Tobin, & VanderGoot, 1995; Jargowsky 1996), we allow the boundaries of the metropolitan areas to change for each census, permitting us to capture the full income diversity of the population then residing in each area.

In keeping with most other research on neighborhood income diversity, we use census tracts as our secondary spatial unit of analysis (Abramson et al., 1995; Galster & Mincy, 1993; Galster, Quercia, Cortes, & Malega, 2003; Jargowsky 1996, 1997; Massey & Denton, 1988; Massey & Eggers, 1990, 1993). Based upon previous research (Ellen, 1998, 2000; Galster & Mincy, 1993; Lee & Wood, 1990), we included in our study only census tracts with populations of 500 persons or more, not more than 50% of whom were in group quarters, and for whom a family income distribution was reported.

These criteria produced a final sample of 38,499 census tracts in 2000, with fewer in earlier years. Our primary source for census tract data is the Neighborhood Change Data Base (NCDB), which was created by GeoLytics in conjunction with the Urban Institute (GeoLytics, Inc., n.d.). We use the NCDB census "long-form" database, which contains sample data from the 1970, 1980, 1990, and 2000 censuses. The NCDB provides an extensive and high quality data set of census tract information in an easy-to-access format (see Tatian, 2002, for details). It is readily available to planners at modest cost and is easy to use. As noted above, rather than employing the version that adjusts data to time-invariant tract boundaries, we use information for census tracts as they are defined for each particular census.

Defining Neighborhood Income Groups

The NCDB provides a grouped frequency distribution of family (but not household) income for each decade by census tract. From these distributions, we calculated family income groupings based upon HUD income guidelines (see U.S. Department of Housing and Urban Development, 1996, Appendix B). These guidelines specify six mutually exclusive income groups, based upon the adjusted median family income (AMI) for the particular metropolitan area:

- very low income (VLI): families earning 50% or less of AMI
- low income (LI): families earning 50.01% to 80% of AMI
- moderate income (MI): families earning 80.01% to 100% of AMI
- high moderate income (HMI): families earning 100.01% to 120% of AMI
- high income (HI): families earning 120.01% to 150% of AMI
- very high income (VHI): families earning over 150% of AMI

Our specification offers several advantages over the use of absolute income ranges found in the census. First, we are able to control implicitly for regional and metropolitan differences in cost of living by providing a standard based upon each metropolitan area's median income. Second, because we are standardizing income distribution categories across metropolitan areas by relating each to its own AMI, we are able to make straightforward comparisons among metropolitan areas, both across space and over time.

Unfortunately, the six income groups defined by HUD guidelines did not match the grouped NCDB income distribution data. Based on accepted census procedures (U.S Census Bureau, 2002), we interpolated the data in the NCDB categories to obtain a reasonably accurate estimate of family counts within our categories. We used linear interpolation for income ranges of $2,500 or less and Pareto interpolation for larger income ranges.[4]

Measuring Neighborhood Income Diversity

We believe it is revealing to consider two distinct but interrelated aspects of a neighborhood's income distribution: the variety of groups represented, and the degree to which the incomes of the groups represented differ. To measure the former aspect, we use the often-employed nominal entropy index[5] (H) (Fong & Shibuya, 2000; Telles, 1995; White, 1986) for tract i:

$$H_i = -\frac{\sum_{m=1}^{M}[\pi_{im} * \ln(\pi_{im})]}{\ln(M)}$$

where:

π_{im} = the proportion of individuals in income group m ($m = 1, 2, \ldots, M$) in tract i, and

M = the number of income groups (six in this application).

H assumes its maximum value of 1 when each of our six income groups is equally represented in the neighborhood, and assumes its minimum value of zero when only one of the groups is present. H does not reflect which income categories are present in particular proportions, meaning a neighborhood with only two income groups

will have the same value for *H* regardless of which two groups it contains. Thus, *H* provides an overall measure of the variety in the family income distributions of neighborhoods, but does not tell us about the income differences among the largest groupings.

As a result, we also employ the ordinal entropy index (*E*), which was recently developed by Reardon, Firebaugh, O'Sullivan, and Matthews (2006):

$$E_i = -\frac{\sum_{m=1}^{M}[c\pi_{im} * \log_2(c\pi_{im}) + (1 - c\pi_{im}) * \log_2(1 - c\pi_{im})]}{M - 1}$$

where:

π_{im} = the cumulative proportion of individuals in income groups 1 through m (m = 1, 2, . . . , M-1) in tract i, and m = 1 for the lowest income group under consideration (VLI in this case);

M = the number of income groups (6 in this application), and

$\log_2$ = the base 2 logarithm.

E assumes its maximum value of 1 when the two income groups defined at the lowest and highest extremes (in this case, VLI and VHI) each constitute 50% of the neighborhood. In other words, *E* is maximized when the neighborhood's income distribution is as bimodal as possible. Unlike *H*, *E* critically depends on which groups constitute particular proportions of the neighborhood. All else equal, the more dissimilar the income levels of the main groups in the neighborhood, the greater the diversity as measured by *E. E,* like *H,* assumes its minimum value of zero when only one group is present in the neighborhood.

Findings

We began by seeking to discover how income diversity changed in metropolitan neighborhoods over the last 30 years, which required employing both entropy measures of diversity. The nominal entropy index (*H*), which has higher values when income groups' neighborhood shares are more nearly equal, declined slightly in the average neighborhood between 1970 and 2000. Table 1 shows that the mean *H* score across neighborhoods in all 100 metropolitan areas decreased from .915 in 1970 to .900 in 1980 to .880 in 1990 to .876 by 2000. The ordinal entropy index (*E*), which has higher values when higher proportions of neighborhood residents belong to groups with very different incomes, shows that the bimodality of the average neighborhood income distribution increased slightly (if unsteadily) during this period. The mean *E* score registered .77 in 1970, .78 in 1980, .77 in 1990, and .79 in 2000. Together these trends suggest a smaller variety of increasingly disparate income groups constitute our neighborhoods.

This conclusion is reinforced by a closer examination. Table 1 also shows how many tracts later occupied categories that had contained deciles of the distributions of each index in 1970. The top panel of Table 1 shows that the four deciles with the lowest *H* substantially increased their shares of all neighborhoods, while the other six deciles, exhibiting more variety, all saw their shares fall. The share of neighborhoods in the *H* decile with the least variety rose by 7.8 percentage points, whereas the share in the decile with the most variety fell by 5.5 percentage points. All this indicates that, in general, fewer income groups were substantially represented in the typical metropolitan neighborhood in 2000 than in 1970. The bottom panel in Table 1 shows a very different pattern of change in the *E* index distribution, for which the two deciles with the most disparate income groupings increased their shares by 2.9 and 15.0 percentage points, respectively, indicating more neighborhoods with substantial shares having quite dissimilar incomes.[6]

The Rise of the Bipolar Neighborhood

We believe that these empirical trends suggest an increase in a special sort of neighborhood: one that has very few, but very different, income groups substantially represented. This occurs only if neighborhoods have very small shares of middle-income groups and bimodal income distributions. Such neighborhoods can be identified both directly and indirectly.

To identify these neighborhoods directly, we created a ratio based on each neighborhood's *E* and *H* values. The ratio of *E/H* provides a powerful indicator of how bimodal a neighborhood's income distribution has become, given the underlying variety of groups represented. Table 2 demonstrates the mathematical properties of the *E/H* ratio using simplified, synthetic data for seven hypothetical neighborhoods. Moving from imaginary neighborhoods A through E in Table 2 illustrates change from a neighborhood with equal shares of families in each income group to one with an extremely bimodal income distribution: *E* rises, *H* falls, and *E/H* rises steadily. We will now study further those neighborhoods for which *E/H* exceeds 1.00, in which the lowest and highest income groups together make up a majority of the neighborhood.[7] We call these bipolar neighborhoods, or *bipolars*.

Figure 1 shows dramatic trends in the number and share of bipolars. In 1970 there were only 497 bipolars (2% of all neighborhoods). Over the ensuing three decades, their number rose over six-fold and their share over four-fold, to 3,369 (8.8% of the total) in 2000. Their

Table 1. Changes in neighborhood income diversity, 1970–2000.

Distribution of neighborhoods by nominal (*H*) entropy scores									
	1970		1980		1990		2000		
Category bounds for *H*	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	**Change in percentage points 1970–2000**
0–.7809	2,465	10.0	3,939	13.6	5,618	17.5	6,868	17.8	7.8
.7809–.8664	2,462	10.0	3,320	11.5	4,269	13.3	5,813	15.1	5.1
.8664–.9107	2,469	10.0	3,034	10.5	3,719	11.6	5,167	13.4	3.4
.9107–.9369	2,466	10.0	2,821	9.7	3,477	10.8	4,444	11.5	1.5
.9369–.9535	2,463	10.0	2,640	9.1	2,887	9.0	3,811	9.9	–0.1
.9535–.9655	2,477	10.0	2,528	8.7	2,674	8.3	3,280	8.5	–1.5
.9655–.9743	2,466	10.0	2,411	8.3	2,582	8.0	2,854	7.4	–2.6
.9743–.9811	2,451	9.9	2,240	7.7	2,274	7.1	2,290	5.9	–4.0
.9811–.9877	2,457	10.0	2,501	8.6	2,253	7.0	2,231	5.8	–4.2
.9877–1	2,482	10.1	3,556	12.3	2,378	7.4	1,741	4.5	–5.5
N (mean)	24,658	(.91)	28,990	(.90)	32,131	(.88)	38,499	(.88)	(–.03)
Distribution of neighborhoods by ordinal (*E*) entropy scores									
	1970		1980		1990		2000		
Category bounds for *E*	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	**Change in percentage points 1970–2000**
0–.6623	2,464	10.0	3,358	11.6	4,581	14.3	4,846	12.6	2.6
.6623–.7272	2,468	10.0	2,599	9.0	3,008	9.4	3,534	9.2	–0.8
.7272–.7576	2,469	10.0	2,078	7.2	2,179	6.8	2,517	6.5	–3.5
.7576–.7783	2,469	10.0	2,044	7.1	2,059	6.4	2,210	5.7	–4.3
.7783–.7948	2,460	10.0	2,183	7.5	2,147	6.7	2,191	5.7	–4.3
.7948–.8091	2,475	10.0	2,370	8.2	2,199	6.8	2,362	6.1	–3.9
.8091–.8230	2,454	10.0	2,657	9.2	2,638	8.2	2,719	7.1	–2.9
.8230–.8348	2,465	10.0	3,262	11.3	3,061	9.5	3,512	9.1	–0.9
.8348–.8586	2,470	10.0	3,723	12.8	3,974	12.4	4,969	12.9	2.9
.8586–1	2,464	10.0	4,716	16.3	6,285	19.6	9,639	25.0	15.0
N (mean)	24,658	(.77)	28,990	(.78)	32,131	(.77)	38,499	(.79)	(.02)

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

bimodal distributions have also become more pronounced over time. The table in the Appendix shows that the number of neighborhoods with 1970 *E/H* ratios greater than 1 in each decile increased absolutely by 2000, while the distribution also shifted toward higher *E/H* values.

To confirm these increases in bipolar neighborhoods indirectly, we found that an intergroup exposure index, showing the average percentage of one group makes up in neighborhoods containing members of the second group, or vice versa, increased over this time period. The exposure index for families in the lowest category to families in the highest category (VLI to VHI) rose 2 percentage points from 1970 to 2000, and the inverse (VHI to VLI) rose 1.5 percentage points during the same period.

Table 2. *H, E,* and *E/H* for seven hypothetical neighborhoods.

	Share of families in each neighborhood income group						Resulting statistics		
Neighborhood	**VLI**	**LI**	**MI**	**HMI**	**HI**	**VHI**	***E***	***H***	***E/H***
A	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	0.83	1.00	0.83
B	16.7%	26.7%	6.7%	6.7%	26.7%	16.7%	0.86	0.93	0.92
C	26.7%	16.7%	6.7%	6.7%	16.7%	26.7%	0.93	0.93	1.00
D	33.3%	16.7%	0.0%	0.0%	16.7%	33.3%	0.98	0.74	1.32
E	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	1.00	0.39	2.56
F	15.0%	35.0%	0.0%	0.0%	35.0%	15.0%	0.84	0.73	1.16
G	17.6%	17.9%	14.5%	14.5%	17.9%	17.6%	0.84	0.99	0.85

Characteristics of Bipolar Neighborhoods

Table 3 demonstrates that the average bipolar does indeed have a bimodal (if asymmetric) income distribution, with the lowest- and highest-income groups constituting almost 69% of the total: 21.2% in VLI and a whopping 47.4% in the VHI. They are slightly less diverse than other neighborhoods that are not bipolar according to *E*, but much less diverse according to *H*, and they do contain substantially smaller shares of middle-income families. However the average bipolar contains lower percentages than other neighborhoods of all groups except the VHI, and thus not surprisingly is considerably better off, with average family incomes that are $46,195 (71%) higher than those of other neighborhoods.

Comparing demographic and housing characteristics in Table 4 shows that bipolars are more racially and ethnically diverse than other neighborhoods according to *H*, though they have slightly higher percentages of Whites and Asian residents, and lower percentages of Blacks and Hispanics. They have considerably higher shares of foreign-born residents. The age distribution in bipolars is clearly more skewed toward the middle-aged than in other neighborhoods. But, despite their higher incomes, these are neighborhoods with considerably higher shares of renters, who have moved into the neighborhood more recently than owner occupants, as is common.

Unfortunately, the census does not allow us to obtain a richer portrait of bipolars. Some possibilities that we cannot explore include whether they often contain: high-income, White renters and long-term, low-income minority homeowners; subsidized housing occupied by low-income minorities and high-income White homeowners; mixed-income/mixed-race housing complexes; or other combinations.

Tables 5 and 6 show no obvious patters of location for bipolars by metropolitan scale or region. Neighborhoods in the 10 largest metropolitan areas vary from 29.7% bipolar in New York City to only 5.1% in nearby Philadelphia. Among the 100 largest metropolitan areas, the highest percentages of bipolars are found in New York City and Jersey City, but the next-highest values occur in McAllen (TX), Bakersfield (CA), and New Orleans (LA). The

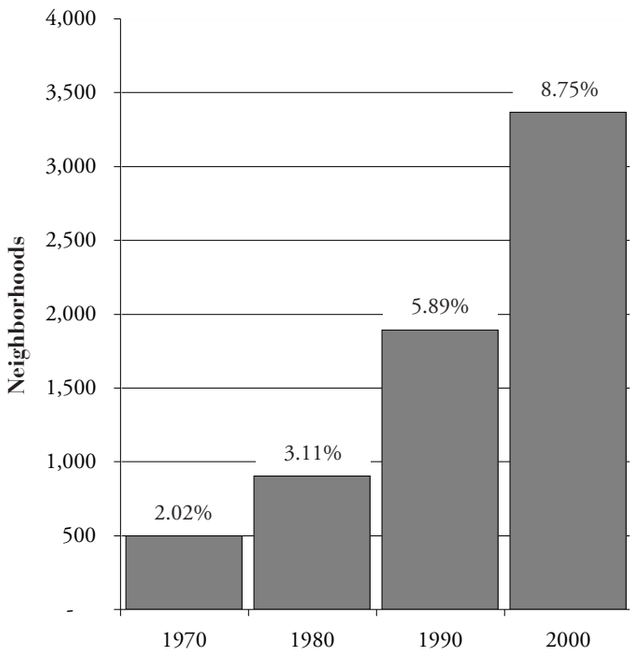

Figure 1. Number and percentages of neighborhoods that are bipolar, 1970–2000.

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

Table 3. Income characteristics of bipolars and other neighborhoods.

	Bipolars: Neighborhoods in which *E/H* is greater than 1		**Others: Neighborhoods in which *E/H* is less than or equal to 1**	
	Mean	**Std. error**	**Mean**	**Std. error**
% of families VLI	21.2	0.32	23.1	0.08
% of families LI	11.3	0.10	18.8	0.04
% of families MI	6.2	0.05	11.7	0.02
% of families HMI	5.7	0.04	10.2	0.02
% of families HI	8.3	0.05	11.8	0.02
% of families VHI	47.4	0.37	24.4	0.09
E	0.776	0.003	0.787	0.001
H	0.732	0.003	0.890	0.001
Average family income	$110,888	$1,154	$64,693	$152
Median family income	$79,350	$757	$54,172	$120

Note:
Differences between bipolar and other neighborhoods on all of these characteristics are significant at $p < .01$ regardless of whether equal variances are assumed or not.

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

Table 4. Other characteristics of bipolars and other neighborhoods.

	Bipolars: Neighborhoods in which *E/H* is greater than 1		**Others: Neighborhoods in which *E/H* is less than or equal to 1**	
	Mean	**Std. error**	**Mean**	**Std. error**
% White	63.6	0.50	61.8	0.17
% Black	14.9	0.44	15.9	0.14
% Hispanic	12.1	0.29	14.8	0.11
% Asian	6.8	0.17	4.7	0.05
Racial *H*	0.489	0.004	0.460	0.001
% Foreign born	17.7	0.24	13.9	0.08
% Age 5 to 17	16.0	0.13	19.0	0.03
% Age 18 to 24[a]	9.1	0.14	9.0	0.03
% Age 25 to 64	55.6	0.16	52.9	0.03
% Age 65 and Over	13.5	0.14	12.1	0.04
% Moved in last 5 years	47.7	0.24	45.8	0.07
% Vacant housing units	7.6	0.13	6.3	0.03
% Units owner-occupied	55.9	0.48	63.6	0.13

Note:
a. The difference between bipolar and other neighborhoods is not significant on this characteristic. Differences on all other characteristics are significant at $p < .01$ regardless of whether equal variances are assumed or not.

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

Table 5. Bipolars in the 10 largest metropolitan areas in 2000.

	Neighborhoods		
Metropolitan area	Bipolars	Total	% Bipolar
Los Angeles–Long Beach, CA PMSA	370	2,016	18.4
New York, NY PMSA	705	2,377	29.7
Chicago, IL PMSA	186	1,799	10.3
Philadelphia, PA–NJ PMSA	64	1,256	5.1
Washington, DC–MD–VA–WV PMSA	66	1,016	6.5
Detroit, MI PMSA	77	1,251	6.2
Houston, TX PMSA	94	760	12.4
Atlanta, GA MSA	51	650	7.8
Dallas, TX PMSA	62	694	8.9
Boston, MA–NH PMSA	63	692	9.1

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

lowest percentages of bipolars occur in a tier of modest-sized metropolitan areas running from Connecticut through Pennsylvania to the upper Midwest.

Explaining the Rise of Bipolar Neighborhoods

While we cannot say definitively why bipolar neighborhoods have become more common, we think they more likely result from changes in income distribution that have reduced the share of families in middle-income groups at the metropolitan scale than from spatial sorting by income. As empirical context, Table 7 shows on average for our top 100 metropolitan areas how the mean shares in each income group have changed between 1970 and 2000. It is clear that in general there have been substantial declines in the shares of MI and HMI groups, and corresponding increases in the shares of VLI and VHI groups on average across the largest 100 metropolitan areas.

So, if the income distributions of metropolitan areas have generally become more bimodal at the extremes, will that also make the income distributions of neighborhoods more bimodal? The tentative answer is "yes," illustrated by

Table 6. Metropolitan areas with the greatest and smallest shares of bipolars.

		Neighborhoods		
Rank, by share bipolar	Metropolitan area	Bipolars	Total	% Bipolar
1	New York, NY PMSA	705	2,377	29.7
2	Jersey City, NJ PMSA	45	155	29.0
3	McAllen-Edinburg–Mission, TX MSA	23	80	28.8
4	Bakersfield, CA MSA	26	134	19.4
5	New Orleans, LA MSA	74	385	19.2
6	Los Angeles–Long Beach, CA PMSA	370	2,016	18.4
7	San Francisco, CA PMSA	67	372	18.0
8	Miami, FL PMSA	61	341	17.9
9	El Paso, TX MSA	22	126	17.5
10	Charleston–North Charleston, SC MSA	17	113	15.0
91	Toledo, OH MSA	4	160	2.5
92	Hartford, CT MSA	7	282	2.5
93	New Haven–Meriden, CT PMSA	3	122	2.5
94	Indianapolis, IN MSA	8	333	2.4
95	Middlesex–Somerset–Hunterdon, NJ PMSA	6	259	2.3
96	Omaha, NE-IA MSA	5	221	2.3
97	Harrisburg-Lebanon-Carlisle, PA MSA	3	138	2.2
98	Minneapolis–St. Paul, MN–WI MSA	12	736	1.6
99	Grand Rapids–Muskegon–Holland, MI MSA	2	224	0.9
100	Allentown–Bethlehem–Easton, PA MSA	0	138	0.0

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

Table 7. Percentages of metropolitan families in each income group, 1970–2000.

Income group	1970	1980	1990	2000	Change in percentage points 1970–2000
VLI	17.2%	19.7%	20.1%	20.6%	3.4
LI	18.5%	17.5%	17.7%	17.8%	–0.7
MI	14.8%	12.7%	12.0%	11.4%	–3.4
HMI	13.2%	12.0%	10.9%	10.1%	–3.1
HI	12.6%	14.0%	13.1%	12.1%	–0.5
VHI	23.6%	24.1%	26.3%	28.1%	4.5

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

Figure 2, which plots the change in the share of neighborhoods that were bipolar in 2000 compared to 1990 against the change in *E/H* in 2000 compared to 1990 for the 100 largest U.S. metropolitan areas. If no one were to move and changes in metropolitan income distributions were proportionately reflected in each constituent neighborhood, these points should fall along a straight line through the origin with a slope equal to 1. Deviations from this line indicate spatial sorting of households by income. Observations above such a line indicate more spatial mixing of income groups, potentially because public policies create more bipolars than would be expected. Examples might include higher-income households moving into previously low-income areas due to gentrification, or affordable housing policies producing opportunities for low-income households to move into high-income neighborhoods. Observations below the line indicate greater isolation of very low- and/or very high-income households than would be caused by changes in the metropolitan income distribution, due to locational changes, such as the rich retreating into homogeneous enclaves or the concentration of high-density public housing in poor neighborhoods.

Figure 2 shows that large deviations from the imaginary 45-degree line are rare, implying that changes in metropolitan income distributions mostly explain the rising incidence of bipolars, though there are exceptions. The growth in bipolars in the New York PMSA during the 1990s, for instance, has been much higher than would be expected based on changes in its income distribution. Thus, we tentatively attribute this growth to New York City's idiosyncratic rent control regime in a context of rapid gentrification. At the other extreme, the McAllen-Edinburg-Mission (TX) MSA evinced a greater decline in bipolars than the growing equality of its income distribution would predict (although the overall incidence of bipolars there remained high), perhaps due to idiosyncrasies associated with its colonias settlements.

To further quantify the contribution of metropolitan income distributions, we generated a counterfactual income distribution for each of our neighborhoods in 2000. The counterfactual assumed that neighborhood income distribution change was caused only by changes in metropolitan income distributions between 1970 and 2000, with no spatial sorting. We recomputed *E*, *H*, and *E/H* for the counterfactual, and compared the results to the actual statistics.[8] The results of from this exercise are: mean E = .80; mean H = .89; percentage of neighborhoods bipolar = 8.4%. Since the mean *E* and *H* values for the counterfactual are one percentage point higher than the actual 2000 values shown in Table 1, we infer that income groups sorted themselves across neighborhoods somewhat differently in 2000 than in 1970, and in ways that tended to reduce the income diversity of neighborhoods overall. This corresponds to findings in Booza, Cutsinger, and Galster (2006).

The share of neighborhoods that are bipolar in the counterfactual is 95% of what it was in actuality. This strongly suggests that, though some differential spatial sorting of income groups occurred over the last 30 years, this was not a major explanation for the dramatic rise of bipolars. Indeed, it appears that the hollowing out of the center of the income distribution that occurred to varying degrees in most metropolitan areas during this era has been primarily responsible for a corresponding increase in neighborhoods with bimodal income distributions and few middle-income families.[9]

Our counterfactual also suggests that gentrification processes, which conventional wisdom might suggest would produce bipolar neighborhoods at least temporarily, have not played a dominant role in this regard for the

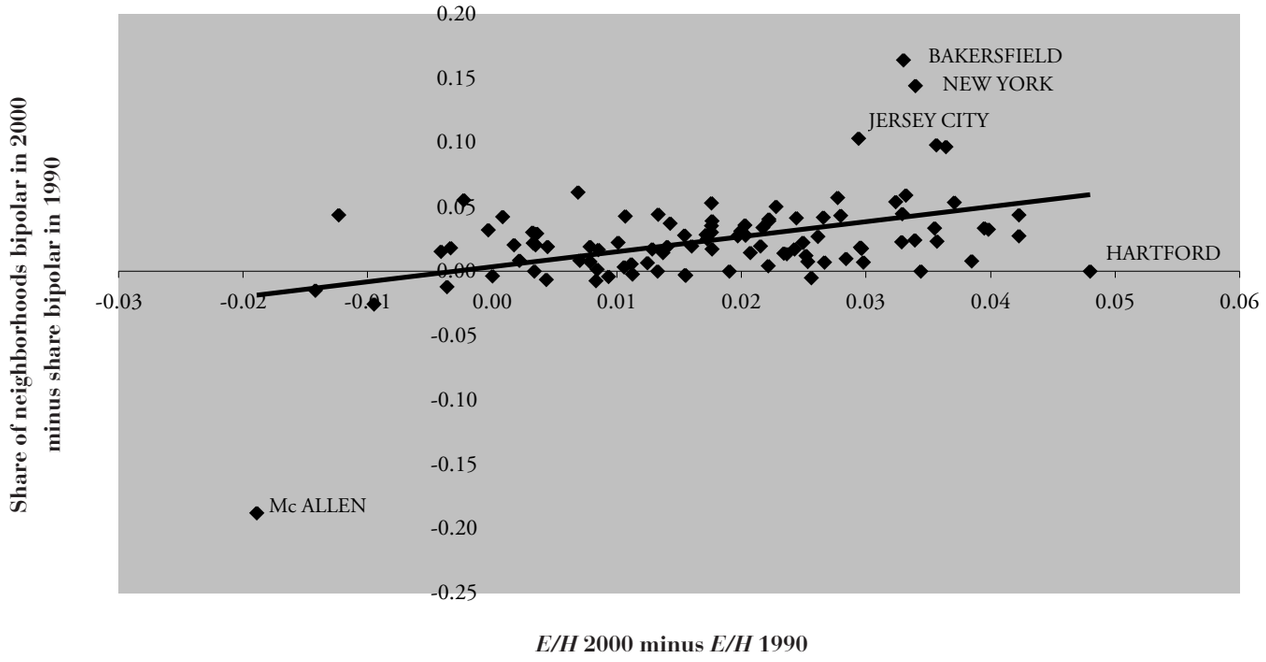

Figure 2. Changes between 1990 and 2000 in metropolitan income inequality (*E/H*) versus changes in share of neighborhoods that are bipolar, for the 100 largest metropolitan areas.

Source: The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.

nation as a whole. This is further supported by our analysis using Freeman's (2005) gentrification indicator.[10] We began by identifying neighborhoods that were bipolar in 2000, but not in 1990, either because they did not exist in 1990 or because their *E/H* ratios did not exceed 1 at that time. Of this group that became bipolar between 1990 and 2000, only 10.6% had gentrified during the decade according to Freeman's criteria.[11]

Despite the relatively minor role of gentrification processes in general, however, it is clear that the housing stock must have changed to become affordable to a range of different incomes in neighborhoods that became bipolar over the last 30 years. This may have occurred in several ways.[12] First, homeowners may have paid off their mortgages by the time they reached retirement and its associated reduction in income, and thus were able to continue to live beside their now much higher-income neighbors. Second, homes and apartments formerly occupied by middle-income households in locations near very high-income households may have been downgraded to accommodate lower-income in-movers, and those in locations near very low-income households may have been upgraded to suit higher-income families. Third, private developers may have developed new, perhaps age-restricted, complexes containing a wide range of price points, possibly to meet requirements for inclusionary zoning or for programs like the Low Income Housing Tax Credit (LIHTC). Fourth, the public sector may have redeveloped homogenous low-income complexes into more diverse neighborhoods, such as through the HOPE VI program. Fifth, efforts to assist and encourage rental housing voucher holders to move into apartments in higher-income neighborhoods may have been more intense than previously. Sixth, in some cities long-term rent control may have permitted high degrees of income mixing within apartment complexes and at larger spatial scales. Unfortunately, assessing the relative influences of these potential explanations is beyond the scope of this article.

Assessing the Potential Consequences of the Rise of Bipolar Neighborhoods

Although our discussion of possible social consequences must be speculative, two have often been at the core of planners' concerns: intergroup stereotyping and social

mobility. Unfortunately, existing scholarship is divided on which impacts may ensue and whether they ultimately will prove beneficial to lower-income residents.

According to the well-known "contact hypothesis" (Pettigrew, 1998; Pettigrew & Tropp, 2006), residential propinquity among different groups creates the spatial context for enhanced face-to-face interactions. These interactions, in turn, can build collective solidarity and erode intergroup stereotypes and prejudices that individuals in both groups may previously have held. This position argues that neighbors often find stronger bases for commonality and solidarity than do individuals meeting in other social settings, such as work. However, erosion of (racial) stereotypes has occurred only in the context of contacts among residents of equal status, as would not be the case in bipolar neighborhoods. Although the rise of bipolars does enhance the opportunity for contact among individuals of widely differing incomes, whether this will ultimately have the effect of withering or reinforcing class-based prejudices is unclear.

Whether social mobility will be enhanced by growing numbers of bipolar neighborhoods relates to how economic diversity within neighborhoods affects lower-income residents. The neighborhood has often been considered crucial to what analysts now commonly describe as the "geography of opportunity" (Briggs, 2005; Galster & Killen, 1995). It is useful to distinguish three categories of neighborhood effects: (1) local resources and institutions, (2) networking, and (3) role modeling and social control.

It first may be argued that increasing numbers of high-income neighbors will aid the less well-off nearby by financially supporting a stronger set of local institutions (both secular and religious), exerting the political clout to obtain higher-quality municipal services and facilities (including public schools), and creating demand for local retail establishments that will generate new job opportunities for those of modest skills. Though these arguments may be valid, they have not been empirically validated, due in part to challenges in measurement and the likelihood of nonlinear, threshold-like relationships (Quercia & Galster, 1997).

As for networking, social scientists have hypothesized many potential varieties of social interactions among neighbors of different economic statuses that could enhance the lower-status group's opportunities for upward social mobility (Ellen & Turner, 2003; Gephardt, 1997). Granovetter (2005), for example, has stressed the instrumental value of "weak ties" among networked acquaintances in supplying critical information about employment and other opportunities for social advancement. But such ties require certain kinds of social interactions among groups, and the existing evidence suggests such interactions among highly disparate income groups are not common.

Many studies have used natural experiments involving public housing redevelopment, rent vouchers, or inclusionary zoning laws to observe disparate income groups within neighborhoods; see especially Rosenbaum (1991, 1995), Rosenbaum, Reynolds, and DeLuca, (2002), Briggs (1998), Kleit (2001a, 2001b, 2002, 2005), Schill (1997), Clampet-Lundquist (2004), Popkin, Harris and Cunningham (2002), and Rosenbaum, Harris, and Denton (2003). These works consistently show that the social relationships among members of different (especially widely different) economic groups are quite limited, even within the same neighborhood or housing complex. Members of the lower-income group often do not take advantage of propinquity to broaden their "weak ties" and enhance the resource-producing potential of their networks, instead often restricting their networks to nearby members of their own group or to those remaining in the "old neighborhood." This suggests that social networking may be a powerful neighborhood force among members of a given group, but less so between members of different groups. Thus, bipolars are unlikely to be places where social mobility is enhanced by connecting lower-income residents to resource-rich networks of their high-income neighbors. This is consistent with skeptical reviews of the evidence on potential benefits of mixed-income neighborhoods for the poor (Joseph, 2006; Joseph, Chaskin, & Webber, 2007) and emerging econometric evidence (Galster, Andersson, Musterd, & Kauppinen, in press).

Yet, bipolars may provide enhanced opportunities if the role model and social control mechanisms are powerful, as has been argued by Rosenbaum (1991). Indeed, several sophisticated multivariate statistical models have found the presence of affluent neighbors to be associated with various positive outcomes for low-income neighbors and their children, though they cannot identify the underlying mechanism of such correlations (see Crane, 1991, Duncan, Connell, and Klebanov, 1997, Chase-Lansdale, Gordon, Brooks-Gunn, & Klebanov, 1997, Kohen, Books-Gunn, Leventhal, & Hertzman, 2002, and Galster et al., in press).

Conclusions and Implications for Planners

During the last 30 years, a new type of neighborhood has emerged in American metropolitan areas. This bipolar type of neighborhood is defined by a predominance of

both very low- and very high-income families, with the middle-income group being severely underrepresented. These neighborhoods differ from other metropolitan neighborhoods in having significantly greater: shares of the very high-income group, racial diversity, shares of middle-aged persons, and shares of renters. The incidence of these neighborhoods has no obvious pattern by metropolitan size or region.

Our simulations indicated that the growth of bipolars appears to be primarily the product of the hollowing out of the middle class at the metropolitan scale rather than new spatial sorting by income, although several possible sorting explanations involve public housing and land use planning policies. For example, it is likely that the longstanding public/subsidized housing and rent control practices of New York City have much to do with its unusually high incidence of bipolars, because they permit those of modest means to remain in neighborhoods that they otherwise could not afford. Moreover, it is obvious that exclusionary and inclusionary zoning regulations, public housing revitalization projects, and criteria specifying tenantry and siting of LIHTC units all can have an impact on neighborhood income diversity, even though quantifying these impacts is problematic.[13]

We have argued that the rise of the bipolars raises important issues related to intergroup stereotyping and social mobility. There are certainly theoretical and empirical reasons to believe that this development may hold felicitous prospects for the well being of the disadvantaged residents in bipolars. However, this outcome is by no means certain. This suggests that scholars and planners should be vigilant, to prevent this phenomenon from producing consequences that are an anathema to the profession.

In closing, we note some caveats to our work and suggestions for future research. This article is the first to employ *E/H* ratios as a measure of the degree of bimodality in a neighborhood's income distribution. Further explorations of the statistical properties of this indicator and how its values change at different levels of geography (especially at scales smaller than the census tract) would be useful. We advocate developing multivariate models to explore whether characteristics of metropolitan areas directly under the control of planners (such as land use and housing policies) may be correlated with the rise of bipolar neighborhoods, and studying metropolitan areas where changes in income distribution seem less strongly connected to changes in the incidence of bipolars. Finally, we recommend further quantitative and qualitative investigations to better ascertain the quality of life on the ground in bipolar neighborhoods and to determine how planning interventions might improve these.

Notes

1. The first meaning of bipolar is "[r]elating to or having two poles. . . ." (*The American Heritage Dictionary of the English Language*, 2000). It is this meaning that we use throughout this article.

2. We distinguish this from a closely related strand of literature that views economic segregation as a metropolitan-level phenomenon: the spatial distribution of different economic groups across neighborhoods in an area; e.g., Abramson, Tobin, and VanderGoot (1995), Jargowsky (1996), Massey and Fischer (2003), Yang and Jargowsky (2006).

3. The U.S. Office of Management and Budget redefines metropolitan areas after each census as new data on population and commuting become available. Between 1970 and 2000 new metropolitan areas have been created, some have expanded due to growth in outlying counties, and others have been subdivided based on changes in commuting trends.

4. For details, see Berube and Tiffany (2004).

5. Many scholars rate the entropy index as the most appealing overall measure of diversity because of its numerous desirable qualities, such as handling multiple groups readily, easy calculation, and decomposability (Allison, 1978; Fischer, 2003; Iceland, Weinberg, & Steinmetz, 2002; James & Taeuber, 1985; Reardon & Firebaugh 2002; Reardon & Yun, 2001; White, 1986).

6. The decile with the lowest *E* did increase its share by 2.6 percentage points, indicating the opposite trend; a growing number of neighborhoods whose predominant income groups were similar.

7. Although it is true that *E* assumes its maximum value of 1 when the neighborhood's income distribution is extremely bimodal, it cannot alone be relied on to identify bipolar neighborhoods. The reason is because *E* (like *H*) does not produce a value that is unique to the neighborhood in question; many neighborhoods with quite different income distributions can produce the same value for *E*. This is demonstrated with the rows for F and G in Table 2. Both hypothetical income distributions evince the same value of *E*, but the F neighborhood is clearly bimodal whereas G is nearly uniform. This ambiguity disappears when we take the ratio of *E/H*: F is flagged as bipolar whereas G is not.

8. We generated our counterfactual by multiplying each neighborhood's 1970 share of each income group by the ratio of the metropolitan area's 2000 share to its 1970 share of the same income group. This provided the income distribution the neighborhood would have experienced had the spatial sorting of income groups in the metropolitan area remained unchanged between 1970 and 2000, and had the neighborhood share of each group paralleled that of the entire metropolitan area during the period.

9. This is consistent with the finding of Mayer (2001), who analyzed the relationship between changes in income distributions and economic segregation at the state level from 1970 to 1990.

10. Combining census tract data with information from the Panel Study of Income Dynamics, Freeman (2005) created a data set that identifies tracts that gentrified between 1990 and 2000. Freeman defined a tract as gentrified based on whether it met the following five criteria: (1) it is located in the central city; (2) its median household income is below the 40th percentile of the metropolitan area at the beginning of the intercensal period; (3) its percentage of housing built over the past 20 years is below the 40th percentile for the metropolitan area; (4) its percentage increase in educational attainment is greater than that of the metropolitan area; (5) its real housing prices increased during the period. We thank Professor Freeman for use of his indicator.

11. Of all neighborhoods in our sample, 7.2% gentrified during the 1990s according to Freeman's criteria, and 10.9% of these were bipolars.

12. We are indebted to participants in our session at the APA Conference in Philadelphia for making several of these suggestions. We

particularly note the valuable feedback from Casey Dawkins, Creigh Rahenkamp, and Alex Schwartz.

13. However, see Pendall (2000).

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Appendix

Bipolar tracts in 1970 and 2000 in *E/H* deciles defined for 1970.

			1970		2000	
Decile	**Lower bound *E/H***	**Upper bound *E/H***	**Number of bipolar tracts**	**% of all tracts in the decile**	**Number of bipolar tracts**	**% of all tracts in the decile**
1	1.000	1.005	50	10.1	245	7.3
2	1.005	1.011	51	10.3	335	9.9
3	1.011	1.019	47	9.5	319	9.5
4	1.019	1.026	51	10.3	279	8.3
5	1.026	1.036	50	10.1	313	9.3
6	1.036	1.050	49	9.9	397	11.8
7	1.050	1.066	49	9.9	347	10.3
8	1.066	1.094	51	10.3	369	11.0
9	1.094	1.143	50	10.1	376	11.2
10	1.143	Max. value	49	9.9	389	11.5

Source:
The authors' analysis of census tract data for the largest 100 U.S. metropolitan areas in 2000 from the Neighborhood Change Data Base.