Poverty and Connectivity

Crossing the Tracks

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Abstract

The spatial structure of cities influences the patterns of development and the spatial distribution of income groups. Past studies have shown that historically the integration of streets is a strong predictor of wealth and poverty in London. Although the current societal and regulatory characteristics of Atlanta, Georgia, U.S.A. differ considerably from those that have historically prevailed in London, recent research has shown that street network integration and connectedness correlate significantly with measures of wealth and poverty in different manners at different scales.

The spatial concentration of poverty and the segregation of income classes are associated with specific problems in the U.S. as elsewhere: negative externalities include poor access to employment, lack of social networking opportunities, vulnerability, psychosocial effects, political disenfranchisement, and the inadequate provision of services, shops, and amenities. The poor tend to be less mobile, making the spatial mismatch between jobs and low-income housing a significant concern for planners and policy makers. Vulnerability to crime and lack of resistance to disasters are also serious problems. As witnessed in New Orleans after Hurricane Katrina, poor neighborhoods have fewer resources and insufficient social and physical infrastructure for rebuilding or transforming unfavorable urban conditions. Finally, the funding of public schools and patronage at inner-city hospitals is tied to the income of surrounding neighborhoods in the U.S., thus making the equitable provision of services harder.

This paper seeks to understand how urban form, specifically measures of street connectivity, relate to poverty in Atlanta. Initial results indicate that at the scale of larger spatial units, or U.S. Census block groups, connectivity increases as the number of households living in poverty increases. This trend expresses the tendency whereby middle and upper income groups have fled to the suburbs and peripheral urban centers since the 1960s. However, using household-level and other finer-scale data, the results invert. Within a local area, connectivity is associated with an increase in household income. The segregation of income groups by neighborhood is responsible for the larger-scale trend, while the recent popularity of neo-traditional and mixed-income housing as part of a return to a more urban life style for the middle classes may contribute to the smaller-scale trend.

Introduction

The existence of "two Americas" is supported by examination of income and quality of life indicators. In Atlanta, five million residents inhabit increasingly homogenous and mutually separated neighborhoods according to income groups. Furthermore, poor neighborhoods are often cut off from the urban fabric by highways, railroads, renewal projects, and other interruptions that create physical and psychological barriers. The poor's access to employment is often discussed by demographers, geographers, and planners in an effort to identify mitigation strategies. The relationship between the urban form and poverty is not well studied in the U.S., however. In this paper, we examine how street connectivity, income, and poverty are related. In order to determine whether impoverished neighborhoods have poor connectivity at a local and global scale, indicators of poverty were compared with several space syntax measures. The entire metropolitan Atlanta region and a subset of local neighborhoods in an historic, traditional area of south Atlanta were each examined.

Individuals, families, and other household units are considered to be living in poverty when they lack the resources to maintain basic health and well-being, such as food, shelter, and clothing. Historically, concentrations of poverty have been redistributed by economic and technological shifts. In the past, cities were characterized by physically mixed social classes (Massey 1996). The industrial revolution led to rapid urbanization and marked segregation of social classes. In the U.S., the rise of the middle class after World War II alleviated the spatial polarization somewhat; however, the "white flight" and exodus from the cities in the 1970s reversed this trend. Currently, the spatial isolation of the poor in the U.S. is continuing to rise due to global industrial restructuring, the contraction of the welfare state, and rapid urbanization (Badcock 1997).

A host of problems is associated with the spatial concentration of poverty and the segregation of income classes in the U.S. These include poor access to employment, lack of social networking opportunities, vulnerability, psychosocial effects, political disenfranchisement, and the adequate provision of services, shops, and amenities. The poor tend to be less mobile, making the spatial mismatch between jobs and low-income housing of particular concern (Chapple 2006). Vulnerability to crime and lack of resistance to disasters is also a serious problem. As witnessed in New Orleans after Hurricane Katrina, poor neighborhoods have fewer resources for returning and rebuilding (Wilson and Stein 2006). Finally, the funding of public schools and patronage at inner-city hospitals is tied to the income of surrounding neighborhoods.

Concentrated and disconnected poor neighborhoods take various forms. We propose to think of these as *ecologies of poverty*. A few examples are immediately suggested by a first examination of the Atlanta region, namely public housing projects, disinvested urban (and inner-ring suburb) neighborhoods, and spaces of opportunity (often occupied by recent immigrants) which exploit key infrastructure, such as major urban roads, or the vicinities of some public transit stations. Homeless shelters and privately developed affordable housing (generally subsidized with public tax credits) are perhaps less prominent. Some of the ecologies of poverty are practically invisible to the average metropolitan dweller; others, especially those taking advantage of urban infrastructure in order to generate opportunities for small scale economies, are at least in part visible; they function as interfaces between local poorer populations and richer populations passing through, or attract visitors who take advantage of what local establishments have to offer. Given the different ecologies of poverty, can place-based policies be instituted that would create economic opportunities for the poor? The U.S. Department of Housing and Urban Development (HUD) has explicitly targeted the warehousing of the poor that has been maligned by Jane Jacobs and others. The HOPE VI program seeks to "less[en] concentrations of poverty by placing public housing in nonpoverty neighborhoods and promot[e] mixed-income communities" (HUD 2008). While housing characteristics, mix of uses, and other elements of the New Urbanist HOPE VI program are commendable, the accessibility and connectivity of the street network in these developments should also be taken into consideration.

According to Vaughan, the relationship between space and poverty has been discounted by researchers and decision-makers. Vaughan states that, "The importance of space itself in having an impact on people's lives is rarely highlighted in contemporary studies of life in poverty, despite the fact that accessibility to the economic life of the city is clearly of as paramount importance today, as it was 100 years ago" (Vaughan 2007, 234). Clearly, it is necessary to examine the impacts of the urban form on poor neighborhoods, as Vaughan has done in London. In this paper we seek to understand how the urban form, specifically space syntax measures of street connectivity, relates to income and poverty.

Methodology

The methods employed to determine the relationship between poverty and street connectivity include several scales of analysis. First, average neighborhood connectivity at the U.S. Census block group level is compared with measures of income and poverty. Next, property-level single-family home sales prices from 2000-2006 are compared with street connectivity measures for a quadrant of south Atlanta near the proposed Beltline light rail project. The area selected consists of portions of 24 block groups and 11 distinct single-family residential neighborhoods. Finally, streets that cross or bound block groups are studied to determine whether higher connectivity is associated with creating an interface, or a stitch, between areas inhabited by diverse income groups. In essence, we ask three questions: is connectivity associated with strong income differentials at a global scale? Is it associated with strong income differentials at a local scale? Is the connectivity of major urban roads associated with urban interfaces across distinct income groups?

Street connectivity measures include metric reach and directional reach. Metric reach is essentially a function of the density of connections over an area. It measures the total length of street grid accessible within a given distance from a start point and tends to be much lower for a point along a cul-de-sac than for a point in a gridded neighborhood. Reach is calculated from the midpoint of all street segments in the area under consideration. Directional reach is the amount of street length accessible from a point within a certain number of direction changes. The minimum angle to constitute a direction change has been set at ten degrees. Both types of reach were calculated at the street segment level using a JavaScript program created at Georgia Tech by Zongyu Zhang working with John Peponis and Sonit Bafna (Peponis, Bafna and Zhang, 2008).

Block Group-Level Analysis

First, connectivity and poverty are examined for the Atlanta region at the level of 2000 U.S. Census block groups. A block group is a cluster of multiple city blocks. The entire ten-county Atlanta region, which consists of 1,563 block groups, is included in this analysis. The mean area of block groups in the region is 1,238 acres (5 km^2). The minimum is 22 acres (0.09 km^2) and the maximum is 25,294 acres (102 km^2). Several Census variables were selected to represent the relative poverty of each block group. These include median household income, percent unemployment, and the percent of households with a ratio of household income in 1999 to poverty level income of less than 0.50. Based on the Census designation of poverty, this can be defined as the percent of households in the block group living well below the poverty level. A poverty line is set by the U.S. Census and factors in the cost of food per person for a given household size.

Street connectivity measures were compiled for each block group. As previously discussed, these included average metric reach for 1 mile and 0.25 miles and the average directional reach for 2 direction changes. Streets and block group polygons were overlaid using an identity function in GIS. Street segment length was then calculated for each segment and each segment portion where streets were bisected by block group boundaries. The metric reach and directional reach for each segment was multiplied by the length to weight connectivity by length of street network. Average connectivity values were then created by dividing this weighted figure by total street length.

Initial Pearson correlations, shown in Table 1, demonstrate a strong positive relationship between connectivity and poverty, a finding that does not conform to the original hypothesis. It was believed that poor neighborhoods in Atlanta lack strong connectivity, making access to economic opportuneties difficult. On the contrary, poor neighborhoods are associated with higher overall street connectivity at the block group level. This finding could be in part due to the concentration of poverty, particularly subsidized housing projects, in downtown Atlanta. At this larger regional scale, connectivity is highly (negatively) related to distance from the central business district. Many of the poorest neighborhoods in Atlanta are near this dense urban area, where blocks are smaller and streets density is higher. We also note that downtown Atlanta has good global connections through the interstates and through public transportation, at least in comparison to other areas of the metropolitan region.

Variables with the strongest correlative power with respect to reach at a local scale (reach 0.25 miles) include the poverty variables of median household income, percent poverty, and percent unemployed. Alternative urban form variables are also compared to determine covariation. It was found that, of the three variables chosen, distance to the center produces the strongest correlations with all syntactical measures over net residential density (or the number of housing units per acre of residential land cover) and median year built of homes in the block group. Furthermore, net residential density was not significantly associated with directional reach of 2 direction changes, indicating that higher density residential areas are not influenced by cognitive street accessibility. Finally, three economic and demographic variables – employment density, population density, and percent of the population that is black – were selected to examine how other possible explanatory variables correlate to syntax variables. The relationship between dense intown, historically black neighborhoods and poverty was believed to be influencing the results. Employment and population density and percent of the population that is black did indeed produce significant correlations with syntax variables.

		Poverty and income mix variables			Urban form variables			Economic and demographic variables		
		Median household income	% poverty	% unemployed	distance to central business district	Net residential density	Median year built	employment density	population density	% black
Metric reach 1 mile	Pearson Correlation	-0.42	0.51	0.44	-0.65	0.13	-0.16	0.30	0.56	0.36
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metric reach 0.25 mile	Pearson Correlation	-0.43	0.51	0.42	-0.59	0.11	-0.14	0.30	0.52	0.36
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Directional reach 2 direction changes	Pearson Correlation	-0.41	0.40	0.33	-0.41	0.05	-0.10	0.18	0.29	0.36
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00

Table 1
Pearson correlation results

Separate linear regression analyses were completed for the three syntax variables as dependent variables and the three measures of poverty as independent variables (Table 2). All relationships are statistically significant at a 95% confidence interval, with a strong negative relationship between income and connectivity and strong positive relationships between poverty and connectivity and unemployment and connectivity. Metric reach of 0.25 miles (an easily walkable distance and an indicator of local accessibility) and metric reach of 1 mile (a more global scale of connectivity) were associated more strongly with the poverty measures than directional reach of 2 direction changes. If we take into account that movement densities are associated with directional reach, this result suggests that dense connectivity – rather than some particular aspect of spatial structure or the street spines that draw natural movement – is more strongly associated with the presence of poverty.

One possible explanation for this result is the fact that in Atlanta (as in many U.S. cities), the most desirable neighborhoods for most middle- to upper-class families are in the suburbs, where connectivity is quite low. In order to control for this relationship, population density, distance to the downtown center, and average age of housing units were calculated as proxies for "suburbanness." Multiple correlation and multiple linear regression analysis were conducted to isolate the effects of the independent variables. Most interestingly, when density measures are included in the correlation, the relationship between poverty and metric reach 1 mile decreases slightly (from 0.51 in the previous correlation) but is still positive and significant (0.444).

	Median household income	% poverty	% unemployment
Metric reach1mi R^2 *Significance (2-tailed)*	0.180 0.000	0.290 0.000	0.192 0.000
Metric reach 0.25mi R^2 *Significance (2-tailed)*	0.186 0.000	0.280 0.000	0.176 0.000
Directional reach 2 direction changes R^2 *Significance (2-tailed)*	0.169 0.000	0.066 0.000	0.107 0.000

Table 2
Linear regression results

Multiple regression analysis, particularly Model 1 in Table 3 where metric reach 1 mile and population density are the dependent variables and percent poverty is the independent variable, yielded very curious results, given the findings above. In this case, the explanatory power of the relationship is slightly weaker R^2 = 0.257 versus 0.290). Based on the beta coefficient values, population density has no significant effect on the percent in poverty when controlling for the effect of metric reach 1 mile on poverty. Clearly, poverty and connectivity are positively correlated, as are poverty and population density (with a statistically significant Pearson correlation of 0.274) and connectivity and population density. Apparently, as poverty increases, connectivity increases, however density decreases when controlling for the effects of connectivity. Below, specific block groups were examined to investigate further this phenomenon. Model 2 of Table 3 shows that the relationship between metric reach 1 mile and percent poverty remains positive and significant when two variables are included: median age of housing units and distance to the geographic center of downtown Atlanta. Thus, poverty is associated with high connectivity more than with decreasing distances from the urban center of older buildings.

Model 1

Predictors:	Standardized coefficient (Beta)	t	Sig.
Constant		34.378	0.000
Metric reach 1 mile	0.517	19.538	0.000
Population density	-0.19	-0.19	0.475
Dependent variable: % poverty, R^2 = 0.257, Sig. = 0.000			

Model 2

Predictors:	Standardized coefficient (Beta)	t	Sig.
Constant		-2.443	.015
Metric reach 1 mile	0.374	13.197	0.000
Distance to center	-0.231	-8.221	0.000
Median year built	0.066	2.981	0.003
Dependent variable: % poverty, R^2 = 0.290, Sig. = 0.000			

Table 3
Multiple linear regression results

These results are interesting, particularly given observable patterns of development in Atlanta. In order to seek out examples of how the statistical results might be manifested on the ground, block groups with high connectivity, low population density, and high poverty rates were sought. Block groups that met these conditions were overwhelmingly public housing projects undergoing redevelopment. At the time in which the Census data was collected (2000), several high density, urban renewal-era housing projects had been razed and residents relocated as part of the federal

HOPE VI program, which replaced modernist towers with lower-rise, mixed income structures. The anomaly of many public housing projects being vacant or at partial capacity likely skewed the above results. The lesser association of poverty with density might, to some extent, be an artifact of our using 2000 Census data.

Overall, our analysis does not support the hypothesis that poor neighborhoods have inadequate access to the urban grid. On the contrary, poverty at the block group level is associated with higher connectivity and shorter distances from center. Quite possibly, segregation by income may occur not through street structure but though control over building interiors in dense areas of Atlanta, where the poor and high value corporate investments are found in close proximity.

Poverty can also be associated with lower densities, insofar as public housing projects for the poor influence the numbers. Often, housing projects were designed according to modernist ideas of controlled densities and open space. The housing projects, however, are accommodated within the overall framework of the street grid. We do not have phenomena of intense distortions of the street network on public housing sites, although superblocks have formed from smaller grids. Mode of spatial segregation might still prevail inside the block, at a finer scale, despite attempts to mix income groups. Our analysis was not aimed to capture this.

Finally, our findings speak of the fact that the middle class in some U.S. cities such as Atlanta, in recent decades, has not sought, or has not been able to obtain urban conditions, or to foster an urban culture. The old urban core has mostly been vacated. This trend is lately reversed in the urban neighborhoods of Midtown and Buckhead, but these reversals are still localized and do not change the overall picture, especially as we use the 2000 Census.

Property-Level Analysis

Figure 1
Neighborhoods in southwest Atlanta chosen for property-level analysis

We pursued a finer grain analysis, at the scale of individual properties, in a 3,000 acre (13 km^2) area south of downtown Atlanta. This area was selected for its diversity of income levels, consistency of housing types, and location near major infrastructure, including a proposed light rail project. The 11 neighborhoods in this area, shown in Figure 1, range from very desirable to transitional to blighted. Several major arterials, interstate highways, and railroads intersect the area, often limiting connectivity between neighborhoods. Property sales data from 2000-2006 (recorded by the Fulton County Tax Assessor) were available for single-family homes in the 11 neighborhoods. Examination of an urban area with a common history and similar urban form was also intended to control for the effects of including both suburban and exurban areas in the earlier block group analysis.

Sales data by year	Metric reach 1 mile	Directional reach 2 direction changes	Metric reach 0.25 miles	N properties (total=4961)
2000	0.045*	0.007	0.004	514
2001	0.015*	0.004	0.004	503
2002	0.001	0.007*	0.008*	573
2003	0.080*	0.000	0.000	628
2004	0.023*	0.001	0.000	771
2005	0.056*	0.003	0.001	850
2006	0.048*	0.009*	0.001	878
last sale 2000-2006	0.040*	0.003*	0.002*	2384
** results significant at the 95% confidence level*				

Table 4:
Linear regression results, R^2 values

Parcel information, including property sales data, was assigned to street segments by first converting parcel polygons to centroids and then spatially joining centroids to the nearest segment. Based on linear regression analysis, the strength of the relationship between sales price and connectivity was weak for all measures of reach and directional distance (Table 4). It was most interesting that the relationship was weakly positive and, in the case of metric reach 1 mile, nearly always statistically significant, indicating that improved connectivity and integration is associated with higher property values in this area of Atlanta. The apparent disparity between this result and the previous results obtained by the block group analysis may be due in part to the incompatibility of income and poverty statistics and housing sales. It is more likely, however, that the relationship of poverty to connectivity also works at a local level, street by street, or indeed street segment by street segment, rather than area by area.

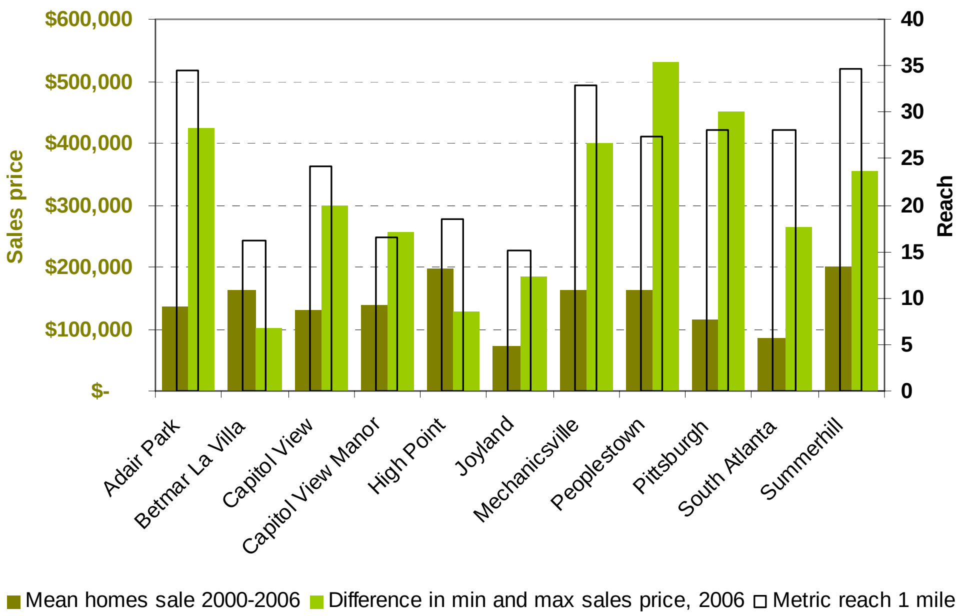

Figure 2
Comparison of mean single-family home sales (2000-2006) by neighborhood, difference in 2006 minimum and maximum sales price by neighborhood, and average 1 mile metric reach

The average connectivity and property values of each neighborhood were also determined. The mean home sales price and mean metric reach for a length of 1 mile is shown in Figure 2. According to these figures, High Point and Summerhill witnessed the highest sales prices in the area while Joyland and South Atlanta had the lowest. Summerhill and Adair Park provided access to the most street network and Joyland and South Atlanta the least. Most striking are the ratios of connectivity to property value by neighborhood. High Point seems to typify the suburban cul-de-sac model of middle-class homes while South Atlanta and Adair Park have more modest home prices and better connectivity. The spectrum of neighborhood types begins to emerge in this diagram. As anticipated, the connectivity of the urban form and the approximate affluence of an area can vary quite significantly at a local level of analysis. The size of Census geometries in the block group analysis suppressed these effects.

Figure 2 also illustrates the difference in the minimum and maximum sales prices for all properties sold in 2006 by neighborhood. The magnitude of difference is clearly larger in certain neighborhoods. These figures may be thought of as a measure of the extent to which a neighborhood is in social transition. Neighborhoods with lower differences would be more stable, while high differences would indicate a higher rate of change or a more diverse neighborhood. Interestingly, the stable neighborhoods in this area tend to have lower mean home sales. These data show a surprising correlation between lower property values, low connectivity values and stability. It appears that the neighborhoods undergoing transitions in home prices (likely due to gentrification) are in more connected areas. These neighborhoods are clearly more desirable or at least more visible to prospective buyers. It should be noted that all data were collected before the recent downturn in the economy and resulting devaluation of many properties. As of 2006, rampant speculation and mortgage fraud had begun to surface and foreclosures in this area were on the upswing. Sales in 2007 and 2008, which were not yet available, may reveal an even more volatile situation. More connected neighborhoods (and perhaps disconnected yet stable neighborhoods) would be expected to fare better than a neighborhood like High Point, which has relatively low connectivity and a high (if consistent) mean sales price.

Based on parcel level analysis, it appears that there is a resurgence of urban culture associated with the middle classes, at least in some parts of Atlanta. Perhaps the correlation between connectivity and income or poverty is not automatic but passes through the spatial logic of society and culture. Thus, the spaces occupied by the middle class and the poor fluctuate in a manner that relates to street configuration. Until we understand the logic that maps social practices to space, and social solidarities to space, we cannot fully understand the geography and ecology of poverty.

Boundary Conditions

To determine the manner in which space creates interfaces between income groups and how connectivity influences income diversity, street segments forming boundaries between Census block group geometries were examined in more detail. Where a street segment is associated with greater income differences in the surrounding areas, the potential is created for awareness, understanding, and even economic exchanges or opportunities across income groups and lifestyles. Thus, street segments that serve as boundaries or cross through multiple block groups were isolated for this analysis. Given that income and poverty data were readily available at the block group level and that block groups are defined by city streets, highways, and other linear features, this method was expected to give a reasonable overview of the interaction between income diversity and street connectivity.

The 19,433 street segments (11% of all street segments in the Atlanta region) used in this analysis constitute those that intersect through more than one Census block group. These street segments were assigned two measures of income diversity. First, the percent difference in median household income of the block groups traversed by the segment was determined. For segments that crossed more than two block groups, the minimum and maximum median household income were used to calculate this measure. This variable ranged from 0% to 92%, with an average of 22%. Second, the difference in percent of the population living in poverty of the intersecting block groups was calculated. Again, for segments that crossed more than two block groups, the minimum and maximum percent living in poverty were used. This ranged from 0% to 54% with a mean value of 4%. The three space syntax measures used in previous analysis – metric reach 1 mile, metric reach 0.25 miles, and directional reach of 2 direction changes – were used again.

		% difference in median household income	Difference in % poverty
Metric reach 1 mile	Pearson Correlation	0.21	0.32
	Sig. (2-tailed)	0.00	0.00
Metric reach 0.25 mile	Pearson Correlation	0.12	0.23
	Sig. (2-tailed)	0.00	0.00
Directional reach 2 direction changes	Pearson Correlation	0.03	0.14
	Sig. (2-tailed)	0.00	0.00

Table 5
Pearson correlation results

Pearson correlations, shown in Table 5, show that there is a significant positive relationship between each of the two measures of income diversity and the three syntax measures used. The relationship was once again strongest for metric reach at 1 mile, followed by metric reach 0.25 miles. The difference in percent of households living in poverty resulted in a stronger relationship than the difference in median household income. The difference in the percentage of households living in poverty more clearly illustrates the how these segments tend to bound areas with different levels of poverty. Most importantly, bounding and crossing segments that are more integrated in the global street network are more likely to join areas with different wealth and poverty characteristics. The data confirm that connectivity is associated with the potential to interface people with different incomes.

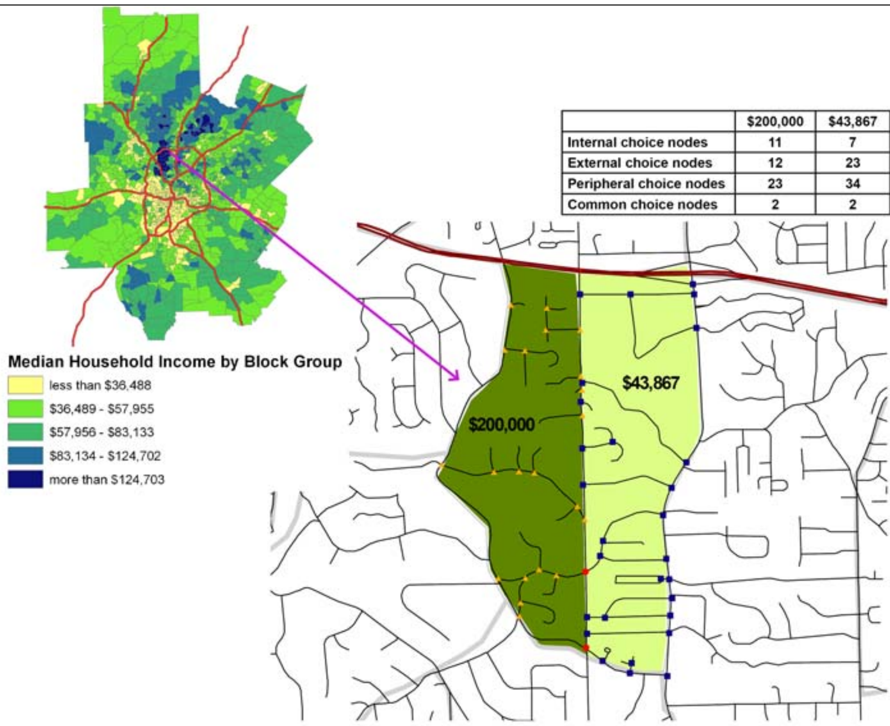

Figure 3
Median household income by Census block group in the 10-County Atlanta region and detail of adjacent neighborhoods in north Atlanta

As an example of the social logic of space that underlies these findings, boundary conditions were examined where a very wealthy and an average income level block group abut in northern Atlanta (Figure 3). Although the two neighborhoods share a common boundary, very different internal and external connectivity conditions were observed. Each neighborhood is traversed by very few unbroken streets. The modest neighborhood has fewer culs-de-sac but also fewer internal intersections, or choice nodes where three or more segments meet. Interestingly, this neighborhood has significantly more nodes on the periphery leading outside of the neighborhood. In other words, the lower income neighborhood is more "extrovert." Its internal street layout seems to be about getting its inhabitants to the more globally oriented surrounding streets.

Conclusions

The relationship between the measures of poverty, income, property values and street connectivity is clearly complex and operates in different manners at different scales. Previous studies have shown that the spatial configuration of spaces has an inherent impact on social behavior. For example, retail and other movement-seeking land uses gravitate toward higher movement locations, which are statistically more likely to be well integrated with the urban grid (Hillier 1999). Street integration has also greatly affected the distribution of social classes in London. There, higher-class streets tend to be significantly longer with much more direct accessibility (in terms of directional reach) than lower-class streets (Vaughan 2005). The preceding results present an initial snapshot of poverty and space in Atlanta that both confirms and refutes these findings. As mentioned, metropolitan Atlanta is similar to many Sunbelt American cities, with much of the infrastructure and housing being built since 1960. In particular, growth in the suburbs exploded over this period. While this accounts for some discrepancy in the data, it is nonetheless undeniable that poverty is associated with higher connectivity in the Atlanta metropolitan region at a larger scale and with lower connectivity at a finer scale.

A cultural shift in recent years has begun to replace the suburban culture with an urban set of conditions, which may be captured in the slight difference in age of data (Census 2000 versus later tax assessor data). This means that areas of high poverty are at higher risk of gentrification based on the results of the neighborhood-scale property analysis. Neighborhoods with higher connectivity were more desirable and transitional. Despite the downturn in the housing market, middle-class Atlantans from the suburbs are moving intown, making poor neighborhoods vulnerable. Waves of affluent residents leaving the central city in the mid-twentieth century led to urban decay; now the poor are increasingly relegated to undesirable areas outside of the urban core. If impoverished households are forced into inner ring or even outer ring suburbs that lack adequate public transportation to employment, this could further the divide between the haves and have-nots in the region. Again, it is necessary to understand the dynamics of spatial economy and the social logic of space in order to understand the geography of poverty.

It is apparent that the spatial pattern of poverty has been changing over time, through public housing reform, market conditions, and population growth, and that the poor tend to live in relatively well connected areas when compared with the region and yet remain disconnected from nearby locations. Well connected streets tend to divide or cross through block groups that are more diverse by income and poverty level, but do social or economic connections between these block groups exist? These spaces that have the potential to stitch together different income groups and lifestyles should be examined in further detail to determine whether the patterns of land use and behavior are consistent with the "stitching hypothesis" or whether they suggest dominance of one of the adjoining groups over the others.

The above analysis addresses two basic questions: where are the poor and where are the spaces in which income groups interface. It would seem that, with respect to connectivity, the spaces of poverty may be in flux at any given time, although the amount of instability or likelihood of gentrification is associated with syntax measures. The more important question may be, where should housing for the poor be located or where will the poor be forced to go if displaced? With respect to interfacing of disparate income groups, clearly more connected streets can perform this function more suitably, although more information about the types of development and character of these streets is needed. Syntactic analysis potentially allows planners to move away from broad-brush practices in the style of zoning, where swaths of land are designated “multi-family” or “single-family” and begin to realize that interactions occur at a much finer scale. Furthermore, planners would be wise to refocus on the streets with stitching potential and support their occurrence, interfacing function and sustainability over time.

List of References

Badcock, B. 1997. Restructuring and spatial polarization in cities. *Progress in Human Geography* 21(2): 251-62.

Burton, E. 2000. The Compact City: Just or Just Compact? A Preliminary Analysis. *Urban Studies* 37(11): 1969-2001.

Chapple, K. 2006. Overcoming Mismatch. *Journal of the American Planning Association* 72(3): 322-336.

Fishman, R. 2005. The Fifth Migration. *Journal of the American Planning Association* 71(4): 357-366.

Hillier, B. 1999. The common language of space: a way of looking at the social, economic, and environmental functioning of cities on a common basis. *Journal of Environmental Sciences* 11(3): 333-349.

Lewis, G. 1994. Oppression, knowledge and the built environment. *Political Geography* 13(1): 7-32.

Lupton, R. 2003. *‘Neighbourhood Effects’: Can we Measure Them and Does it Matter?* London School of Economics.

Massey, D. 1996. The Age of Extremes: Concentrated Affluence and Poverty in the Twenty-First Century. *Demographics* 33(4): 395-412.

Peponis, J., S. Bafna, and Z. Zhang. 2008. The connectivity of streets: reach and directional distance. *Environment and Planning B: Planning and Design* 35(5): 881-901.

Schweitzer, L. and A. Valenzuela. 2004. Environmental Injustice and Transportation: The Claims and the Evidence. *Journal of Planning Literature* 18(4): 383-398.

Talen, E. 2006. Neighborhood-Level Social Diversity. *Journal of the American Planning Association* 72(4): 431-446.

U.S. Department of Housing and Urban Development. About HOPE VI. http://www.hud.gov/offices/pih/programs/ph/hope6/about/ (accessed April 30, 2008).

Vaughan, L. 2007. The spatial syntax of urban segregation. *Progress in Planning* 67(3): 205-294.

Vaughan, L., D.L. Chatford Clark, O. Sahbaz, and M. Haklay. 2005. Space and exclusion: does urban morphology play a part in social deprivation? *Area* 37(4): 402-412.

Vaughan, L. 2005. The relationship between physical segregation and social marginalisation in the urban environment. *World Architecture* 185: 88-96.

Wilson, R.K. and R.M. Stein. 2006. *Katrina evacuees in Houston: One year out.* Washington, D.C. National Science Foundation.