# Placemaking: Inequality by Accident or by Design

**Oscar H. Gandy, Jr.,**

Emeritus Professor of Communication, University of Pennsylvania

ABSTRACT

This paper seeks to extend the literature on the neighborhood effect by examining the myriad ways through which surveillance of the past, present and future in the service of urban planning works to reproduce different types of inequality through cumulative disadvantage. We understand the "neighborhood effect" in terms of the association between poverty and disadvantage and spatially located and colloquially named places within cities. The tensions between socio-structural, cultural and individualistic explanations for the scope and stability of these correlations are described before an analytical approach that combines all three is presented.

A key focus in this analytical strategy is the role being played by geographic information systems (GIS) in the development of plans for the transformation of urban spaces. It begins by reviewing patterns of growth in the spread of GIS technology beyond its traditional borders, in part through the popularization of tourism and professional relocation services that make use of maps, labels and index numbers to facilitate the evaluation of cities and neighborhoods in terms of characteristics commonly understood as amenities, opportunities and risks. The assessment of educational systems at the level of schools, walkability within user-determined boundaries, and public safety or "dangerousness" on the basis of levels of exposure to crime, motor vehicle accidents or pollution are just a few of the indicators to be described.

On the basis of this background review, this paper will shift its focus to the consequences for inequality that are inherent in the uses of spatial analysis as aids to public participation in the planning of neighborhood and community change, especially as they relate to an emphasis on public transportation as a feature of so-called "smart growth" initiatives.

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## Introduction

Placemaking refers to the variety of influences that combine to produce the characteristics of a place that help to shape its identity. We understand that natural and social processes shape human beings, including those that might be said to be under the willful control of the self (Cohen, 2013). Similar processes endow places with characteristic features that often aid in their identification or naming by others. Unlike humans, many of the features that mark the edges of places are quite different from those that mark the boundaries between individuals. While formal actions by government bodies can transform combinations of humans into legally significant units like families, corporations and other purposeful associations like cities and towns, it is in only a limited number of circumstances under which previously conjoined individuals can be separated, and none at all through which human beings are functionally combined into single entities.

This paper will focus on a relatively small set of the processes through which places, and the distinctions between them are established and then changed over time. Among the primary distinctions that will explored through the lens of placemaking is the extent of the economic, social and political inequality that exists between individuals, families and households that are often identified as members of socially constructed groups. And, while placemaking as a process is shaped by a variety of technological resources and associated skills, this paper will emphasize those that are recognized as part of an analytical and expressive complex known as geographic information systems (GIS).

Increases in the number of people living within a legally defined place tend to be looked upon by many, but not all people (Molotch, 1976) as a good thing. However recent concerns about the negative environmental impacts of growth have led many to question the wisdom of allowing future growth to continue unconstrained by regulatory oversight (Kramer, 2013). Efforts to engage in environmentally sensitive planning for growth in urban centers have focused on the design of public transportation systems as an alternative to continued reliance on private automobiles.

In order to develop public support for these “Smart Growth” initiatives many jurisdictions have invested considerable time and energy in the involvement of members of the general public in deliberations about how their visions of the future might be brought into being. Because the evolving technology of public participation in planning is certain to affect the levels of inequality within urban neighborhoods, this paper will examine some of the early signs of its likely impact in the United States.

We will begin with a focus on cumulative disadvantage as a generalized model of the processes through which inequality is reproduced across time and space. After taking due note of the myriad of factors, forces and circumstances that combine to distribute both advantage and disadvantage across communities, we consider the role that different forms of surveillance play in the social construction of places and the people that live within them. Because our primary focus is on those places we refer to as neighborhoods, considerable time is spent in exploring the variety of meanings that are associated with

the concept of a "neighborhood effect." Although this effect is usually discussed in terms of the cumulative disadvantages that are shared by the residents of particular kinds of neighborhoods, we also explore some of the processes that actually result in the transformation of neighborhoods in ways that often result in the displacement of their already disadvantaged residents.

We shift direction and focus at this point in order to consider the role that mapping and spatial analysis increasingly plays in the transformation of these neighborhoods. After a brief description of the associated technologies, their primary and secondary users, and uses in relation to placemaking, we focus in still further on the use of GIS in the context of transportation oriented development and "smart growth" initiatives. After describing examples of public participation in several communities in the American West, planning activities in Tucson, Arizona are used as case study in order to reveal how inequality within and between neighborhoods is likely to be reproduced or even exacerbated through choices made about analytical frameworks.

## Background

Our interest in placemaking is shaped by a set of concerns about how our assumptions about the nature of places and the people who make their lives within them actually serve to affect those lives in the future. These concerns arise because our assumptions influence the manner and extent to which we engage with or avoid those persons and the places in which they are likely to be found.

The meaning of any particular place is complex and varies dramatically between observers and across time. This variation is generated as a result of "socially, politically and economically interconnected interactions among people, institutions and systems" (Pierce, Martin and Murphy, 2011: 59). To the extent that these place meanings share common features, we might reasonably assume that the generation of particular "place-frames" reflects the strategic efforts of well resourced, and self-interested parties (Gandy, 1982). The pursuit of self-interest, especially among individuals, organizations and coalitions seeking to capture the economic benefits that flow from the strategic framing of places far too often proceeds without regard for the harms that are generated as a result of those efforts. More often than not, the resultant harm is treated as an unintended byproduct or externality (Gandy, 2009: 56).

Other sources of influence are not at all well understood. Indeed, "the fabric of human geography is becoming increasingly complex: it results from a constantly active pattern of mobility and communication, including content creation that feeds back into the pattern" (González-Bailón, 2013: 293).

Although inequality has become the focus of considerable scholarly attention of late, it is only occasionally examined explicitly as harm, rather than a structural condition reflected in statistical data (Brooks, 2014). Yet, it is through its framing as a social

problem that should be addressed as a target of public policies and programs that the nature of those harms come to be made explicit. Inequality is slowly coming to be recognized as harm for individuals, groups, and for societies at large. This paper will describe the myriad of ways through which the social construction of places is centrally involved in the reproduction and exacerbation of inequality and the harms associated with it. This inequality is most productively discussed in terms of its reproduction over time as cumulative disadvantage (Gandy, 2009).

## Cumulative disadvantage

The effect of cumulative disadvantage (CD) across the life course is perhaps best understood in terms of the variety of pathways that offer opportunities for either stabilization, improvement or degradation of an individual's life chances, or opportunities to attain well-being. Because the driving force behind the scholarly engagement with CD is on its role in explaining the lack of success within particular segments of the population, researchers have tended to focus their attention on a particular stage, node, or turning point in the life course (Gandy, 2009).

Researchers exploring the nature of CD may share a common domain or sphere as an endpoint, such as employment, home ownership, and increasingly, health status, there is great variety in the overlapping domains that they identify as contributing to the measured result. For example, Pacheco and Plutzer (2008) sought to determine the contribution that different forms of economic and social hardship make to the levels of political participation exhibited by young adults.

Members of the Task Force on Inequality and American Democracy of the American Political Science Association have emphasized the importance of civic capacity and public participation to the development of policies to address inequality (Hacker, et al., 2005); it is hard to disagree with their choice. Although political participation is rather narrowly defined in terms of voting, their exploration of the differential influence of family, community, and school in combination with critical life events that might involve interactions with the police and the courts helps to explain how disadvantage accumulates within and across generations.

The neighborhood, or community in which parenting, schooling, peer influence and role modeling take place has also emerged as a central focus for CD research and analysis. As we will explore in somewhat more detail, the ability to define neighborhoods in terms of precise spatial boundaries makes it possible for researchers to develop specific categories of vulnerability or risk as they relate to health status (Morello-Frosch and Jesdale, 2006). The challenge remains one of identifying the specific pathways through which exposure to higher levels of risk, such as heat-related deaths, emerges for people living in particular neighborhoods or census tracts (Harlan, et al., 2013).

While cumulative disadvantage may be an apt description of the relationships between opportunities and constraints throughout the life course, there are reasons to be concerned about reliance on a CD framework to generate strategies to overcome and reverse its influence. Some (Reskin, 2012) suggest that there is far more promise to be found with a systems theoretic path that links racial discrimination with continually emergent barriers to opportunity. Others (Doyle, 2007) point to the political difficulties that have to be faced if both direct and indirect discrimination can be effectively constrained in pursuit of equality. Doyle notes, but does not fully explore the difficulties involved in determining the appropriate balance between benefits to the discriminator, and harms to the victims of discrimination (Gandy, 2011: 182).

## Engaging causal complexity

Inequality is the result of a complex system of interacting vectors of influence that some observers discuss in terms of "intersectionality" (Barnard and Turner, 2011). Although sophisticated statistical models offer insights into the relative contributions being made by particular "variables," problems related to their specification and measurement leaves us far from being confident about the stability of any of these coefficients across explanatory models (Gandy, 2009; Quillian, 2012). Despite uncertainty about the extent of the contribution to inequality being made by location or place of residence, there is little doubt about the fact that place matters considerably. Indeed, the fact that so many of the measures that have been causally related with economic and social inequality are associated with particular places of residence contributes to our difficulty in isolating those causes in order to assess their "independent" contribution (Chetty, et al., 2014).

Changes in the nature of information technology (IT), and the continually expanding variety of uses or applications for the capabilities it provides, undoubtedly contribute to the rate at which economic, social and political inequalities expand around the globe. While it is something of a commonplace for critical observers to focus on the impacts of technology upon the disadvantaged, it is also important to take note of the contributions being made to these widening gaps by the enhancements in the capabilities of those already privileged by class, caste and social position (DiPrete and Eirich, 2006). Increases in income and wealth enjoyed by those at the upper extremes of the distribution undoubtedly reflect the capture of benefits from improvements in efficiency and effectiveness realized through use of personal, as well as professional informational resources, as well as economic advantages realized through legislatures and the courts.

## The Role of Surveillance

It has become increasingly apparent that for those at both ends of the distributions of resources that shape the quality of life, the capture of data generated through networked digital interactions leads to alterations in the structure of opportunities

and constraints that they face. This transaction-generated-information, or TGI, is the output of an analytical process designed to provide actionable intelligence for corporate and government decision-making (Erskine, et al., 2014; Gandy, 2009: 81-86), and the heightening of inequality is often the result of its use.

Although much of the attention being paid to this central feature of "communicative capitalism" (Dean, 2009: 19-48) has come to be focused on "big data" and automated or autonomous decision-making (Bierig, et al., 2013), it is important for us not to lose sight of the fact that for the most part, citizens and consumers are blissfully unaware of the extent to which their activities, indeed, their very being is subject to continuous "remote sensing" (Gandy, 2012) or surveillance (Fuchs, et al., 2012: 16-19). Further, as Andrejevic (2012: 86) notes, without access to the data, knowledge, skills, and technology needed to reproduce the specific algorithmic assessment that assigned them to a specific population segment, it will be all but impossible "to determine why they may have been denied a loan, targeted for a political campaign message, or saturated with ads at a particular time and place."

In addition, assignment to a statistically defined, and perhaps unique "group" removes any reasonable possibility of self-defense or retribution on the basis of some kind of group-based discrimination that may have been explicitly barred by law (Crawford and Shultz, 2013; Doyle, 2007; Segall, 2012; Taylor, 2011-2012).

While it might be the case that the members of a group, such as residents of a particular neighborhood may be Latino or African American, the statistical model that was used to "rate" the community may never have used information about their identity as members of a "protected group." Taylor (2011-2012) notes the difficulties involved in gathering evidence of disparate impact discrimination when decisions have made on the basis of computerized credit scoring models. Poor people who are likely to live in neighborhoods with high rates of foreclosure may be members of minority groups, but their rejection was most likely made on the basis of their being poor, or living among the poor and therefore seeking finance in a neighborhood filled with properties of declining market value (Chester and Mierzwinski, 2014: 7). Unfortunately, the poor have yet to be identified in the US as a protected class, at least with regard to decisions made by private firms (Popescu and Gandy, 2004: 150-152).

And, while the more sophisticated models in use these days are quite capable of accurately predicting the race, gender, political party and ideology of an individual, those determinations tend not to be made on the basis of any individual's responses to any "forbidden questions" about identity (Crawford and Shultz, 2013; Tufekci, 2013: 15-16). Indeed, the fact that these assessments are being made by automated, and largely autonomous systems moves the discussion outside the realm of mainstream thinking about surveillance (Wood, 2007), or policy-oriented musings about privacy (Gandy, 2011; Rouvroy, 2008).

The fact that citizen/consumers are woefully ignorant of the process and effects of automated surveillance provides little in the way of an effective legal defense against invasions of privacy. "Knowledge and consent" is simply assumed, even in the absence of "signed" agreements to be bound by the present and future variants in the almost impenetrable legalese in the online "click-to-proceed" forms most of us feel compelled to complete (Fowler, Pitta and Leventhal, 2013; Gandy, 2011; Gilman, 2012; Pallitto, 2013). For this reason, perhaps, Segall (2012: 96) argues that disparate impact discrimination should be illegal "because it exacerbates inequality of opportunity" even if it was not intentional, and even if the victims are unaware of the discriminatory act.

### Location and Context

At this point we want to call particular attention to a highly significant shift in the quantity and character of individually identifiable TGI being generated by users of a variety of "intelligent" mobile devices (Wellner, 2013). While these devices generate much of this TGI, in part in order to enable their operation across a variety of telecommunications networks, the potentially more significant flows are actually being generated by users through their purposeful sharing of location- and context-specific information to members of their social networks (Humphreys and Liao, 2013; Tufekci, 2013).

Albrechtslund (2012: 195-196) refers to this location sharing as a "mapping practice" that can also be considered a "mastering of the social life." It is reasonable, as he suggests, to assume that there are important differences between the identity and meaning an individual seeks to produce through this sharing and the strategic mapping of citizens and consumers enabled by the efforts of business and industry (Bierig, et al., 2013: 12-13; Logan and Molotch, 1987: 107-108). Some of the most significant differences are likely to be found in relation to the expectations of privacy that individuals may have with regard to the social contexts that they think of as private, or at least reserved to that set of persons that share both a basis for, and a commitment to a common identity (Nissenbaum, 2010; Popescu and Baruh, 2013: 277-278).

As Nissenbaum notes (2010: 227), users "believing that the flow of information about them and others posted to their sites (in their profiles) is governed by certain context-relative information norms, are rightly surprised and indignant, when, for whatever reasons, other actors have diverted these flows in unexpected ways that breach informational norms."

In addition to the remotely controlled sensing of individuals and their interactions with others through social media, we also need to take note the rapid expansion in the number and variety of environmental sensors that generate location and context specific assessments of the "state" of the environment (Blaschke, et al., 2012; Castro and Misra, 2013; Graham, 2005; Kuznetsov and Paulos, 2010). These sensors are

central features of the transformation of space by what is referred to as "ambient intelligence" (Rouvroy, 2008). This is especially important in relation to a variety of indicators that have been established by regulations, professional standards, or competitive industry leaders.

### *Understanding The "Neighborhood Effect"*

It may be said that a theoretical construct has outlived its primary value as a stimulus to research when critics refer to its adherents as members of a "cottage industry" (Slater, 2013). Of course, as with cumulative disadvantage and its limitations as a source of policy initiatives with the potential to overcome it, there is good reason to challenge the optimistic visions behind proposals to erase the effect of growing up in a disadvantaged neighborhood by simply moving families to other neighborhoods where the opportunities for success appear to be greater.

There is no denying the impressive level of empirical support for the claims being made between neighborhood and multiple indicators of poverty and disadvantage (Franklin and Edwards, 2012). Even without being able to identify the paths that flow from residence in particular kinds of neighborhoods to particular kinds of disadvantage (Oakes, 2004) there is no denying the substantial correlations between residence and risk and status. The difficulty remains one of determining "whether the differences in outcomes across areas are due to the causal effect of neighborhoods or differences in the characteristics of people living in those neighborhoods" (Chetty, et al., 2014: 6).

In addition to race and income, educational quality and other public goods have to be considered along with other structural influences, such as the local labor market, which is subject to the influence of migration, social networks, and the social capital accessed through them (Chetty, et al., 2014: 30). The data we would require to assess the relationships between these indicators in individuals, families and neighborhoods across time tend not to be comparable, reliable or readily available.

But of course, even if they were available, such data would be unlikely to come from controlled experiments; families are not often randomly assigned to neighborhoods. Some other process contributes to the formation of neighborhoods that are racially and economically segregated, as well as being marked by higher concentrations of poor families. Certainly the quality of schools within a neighborhood are among the factors being considered by couples as they choose where they want to raise a family. Online resources (www.greatschools.org) provide prospective parents with assessments of school quality by state, city, or even in terms of proximity to a specific address.

Still, it is important to note that still other factors are involved in the choices being made by African Americans as they move from one poor neighborhood to another

(Slater, 2013), even in the context of social programs designed to support them in making a "move to opportunity" (Gandy, 2009: 99-101).

Engaging what he sees as shortcomings in the Massey and Denton's analysis of the role of segregation in *American Apartheid*, Quillian (2012) suggests that there are actually three kinds of segregation that help to generate concentrations of poverty among African Americans. The first is racial segregation, the second is within-race segregation by poverty status, and the third is economic segregation from wealthier members of other racial groups.

Underlying the importance of these forms of segregation are a set of assumptions about how interactions across boundaries of race and class influence not only access to opportunities, but also access to behavioral models of successful adaptation to circumstance (Barnard and Taylor, 2011: 10-12). An individual's network of weak and strong ties is understood to play a critical role in their development of social and economic capital, as well as an array of capabilities that have come to be associated with resilience (Bowles, Loury and Sethi, 2014). Evidence suggests that diversity of the social networks enjoyed by members of a community helps to explain the comparative economic well being of that community (Eagle, Macy and Claxton, 2010).

Quillian's (2012: 376) analysis suggests that it is the poverty status, rather than the race or ethnicity of their neighbors that explains the spatial concentrations of poverty among Hispanics as well as African Americans. This view is reinforced by the analysis of residential income segregation in 117 of the largest metropolitan areas in the US. The project was driven by a concern that "income segregation may accentuate the advantages of high-income families and exacerbate the economic disadvantages of low income families" (Bischoff and Reardon, 2013: 3). These researchers observed that the "increasing geographic isolation of affluent families means that a significant proportion of society's resources are concentrated in a smaller and smaller proportion of neighborhoods" (Bischoff and Reardon, 2013: 34]. This tendency was also accompanied by the increasing isolation of low-income black and Hispanic families.

The theoretical problem then becomes one of explaining how it comes to be that certain segments of the population tend to acquire or maintain housing "in the most disadvantaged neighborhoods," despite what we might see as an expanded set of options. There is little reason to doubt that personal preference plays a role in the selection of some neighborhoods and the rejection of others. There is also no basis for ignoring the structural and institutional forces (Gandy, 2009: 97-102) that shape both the preferences and the resources that determine whether individuals are able to exercise the kinds of autonomous choice that neoliberal policy models assume (Sager, 2011; Slater, 2013: 8-11).

While the literature on the neighborhood effect is focused primarily on the consequences for residents in relation to their experience within particular

neighborhoods, or within different neighborhoods to which they move, very little of this research examines the nature and consequences associated with changes in neighborhoods, and even less examines the causes of neighborhood change (Lee and Lin, 2013).

Researchers concerned about neighborhood change have often focused their attention on gentrification and the economic and social pressures that lead to involuntary exits from communities by poor and minority residents (Smith, 1996, 2002). This process has also been examined in relation to the patterns of spreading decay, which often precedes gentrification. This decay is usually associated with disinvestment enabled, or conditioned by "redlining" by financial institutions (Betts, 2006; Logan and Molotch, 1987: 115-116; Reskin, 2012; Taylor, 2011-2012).

However, it has also been observed that gentrification is also likely to occur in the poorer neighborhoods that are adjacent to initially wealthier neighborhoods. Apparently, "citywide demand shocks" in the housing market leads to in-migration by the comparatively wealthy that results in involuntary exit by the poor (Guerrieri, Hartley and Hurst, 2012). In the view of some, the similarities in these patterns in numerous cities across the globe reflect the influence of a "concerted and systematic partnership of public planning with public and private capital [that] had moved into the vacuum left by the end of liberal urban policy" (Smith, 2002: 441).

## The Problem with the Data

Both descriptive and analytical engagement with the relationship between neighborhood type and disadvantage is dependent upon the availability of the right kinds of data. This is not only a concern about the absence of information; it is also a concern about the kinds of data that tend to be used, in part because it just happens to be available. The availability of data reflects the operation of systems of power and influence that are not always recognized in terms of what these data say about the reality they are supposed to represent. As Johnson (2013: 2-3) puts it "the process of constructing data builds social values and patterns of privilege into the data. Where those values and privileges are unjust, the injustice is then a characteristic of the data itself."

The characterization of neighborhoods on the basis of measured attributes has a long history within the social sciences (Lee and Lin, 2013; Rydin, 2007), but the attributes that drive these explanatory models continue to change. The fact that there continues to be debate about the usefulness of particular indicators of well-being or distress, in comparison with indicators of housing prices or household income may raise concern about the extent to which the "tail is wagging the dog," or whether an emergent theoretical construct, or a placemaking strategy is actually generating demand for a particular set of measures. We might expect that the advocates of new development policy initiatives will call out for the development

and adoption of new indicators that will be more "sensitive" to the kinds of outcomes that are likely to be produced by a particular kind of intervention.

We have also been reminded that "the scales used to delimit places that could be used as units of analysis are products of myriad human action and goals. Places, therefore, are never natural, preformed, or given and there is no such thing as the 'right' scale for any given research topic or interest" (Tita and Radil, 2010: 474).

For example, Jennings (2012: 465) described two recent neighborhood-oriented federal initiatives with "place-based strategies" for which the "systematic measure of neighborhood distress at the census tract level, and development of spatial visualizations of distress levels, can help to identify residential areas requiring greater targeted attention." He also notes that "communicators at sub-neighborhood levels can be used to frame civic discourse around social and economic inequalities" (2012: 470), and he suggests that community organizations might be able to make use of these representations in order to improve the delivery of services.

At the same time he also warns that information about distress and spatial inequality "could still encourage presumptions of pathology or behavioral defects among residents" in these neighborhoods, rather that supporting a critique of "historical and contemporary decision-making in policy and political arenas" (Jennings, 2012: 472).

Rydin (2007) also places the selection of indicators within ongoing debates about "governmentality" and the extent to which a complex goal like "sustainable development" or "smart growth" can actually be achieved through state action. She (Rydin, 2007: 622) sees the use of sustainability indicators (SI) as an attempt at legitimating "what might otherwise be unacceptable policy activity" in part because "the rationality of SIs lies in their self-justification of purposeful, logical, and apparently effective governmental activity."

## Thinking spatially with GIS

We have learned quite a bit about "the power of maps" since we were informed about how that power is often expressed. Much of what we have learned is about what maps can do, and how efficiently and effectively they do those things. (Wood, 1992). What we have a great deal more to learn about are the interests that are served by most of the maps in use. Once we accept the fact that maps create more than they represent, it becomes important for us to understand a bit more about who benefits, and who pays for the realities that are brought into being through the use of maps.

Curry's (1998) brief history of geographic information systems takes due note of cartography's close association with the state and its reliance on information systems in support of efforts to control territories near and far. Understandably, the role of the computer in mapmaking increased dramatically with emergence of what Curry refers to as the "quantitative revolution within geography" (Curry, 1998: 62-63). By the 1970s, technological streams enabling both automated cartography and the analysis of spatial data were merged within geographic information systems (GIS) that supported the examination of difference within an illusion of universality.

While Wood (1992: 184) celebrates the potential that maps represent for humankind, because, as he suggests, "anybody can make a map," the fact remains that many of the forces that create the digital divide in telecommunications are also at work within the cartographic sphere (Graham and Wood, 2001: 243-245; Johnson, 2013).

## The technology

The technology of map-making is continually and rapidly expanding the variety of techniques for representing places and their attributes. Some of the most important advances are to be seen in the visualization of relationships that were previously invisible, in part because their strategic or expressive value had not yet been recognized. For example, Ivanovic (2013) has described the development of "Activity Counter Maps" (ACM) as a technique for visualizing personal space defined in terms of "areas of influence" that combine personal spaces with indicators of "intensity of activity." Observations of behavior within parks in Japan facilitated the representation of those spaces in terms of the kinds of relational activities taking place between visitors. Ivanovic's (2013: 579-580) expectation was that further analysis and visualization of behavioral interactions within spaces with different features would enable the use of personal space and "influence" as design parameters.

Advances in the visualization of spatial information were also marked by an evolving "partnership" between corporate, government and academic interests (Coppock and Rhind, 1991; Torrens, 2010). Such advances actually accelerated as a result of a somewhat unusual, but nonetheless strategic openness on the part of Google to make use of "hacker-generated" applications in support of its consumption-oriented, map-based services (Dalton, 2013).

The rise in government contracting with firms specialized in the capture and analysis of data from remote satellites and drones (Crampton, Roberts and Poorthuis, 2014) coincides with increased interest in the mobility of individuals enabled by their adoption of intelligent mobile devices. Advances in the visualization and characterization of mobile entities and objects will surely alter the meaning of spaces in ways we can only imagine.

The development of Application Programming Interfaces (APIs) that allow relatively unsophisticated developers of online information resources to embed maps into their web pages and documents has also contributed to the relative ubiquity of spatial representations across the network (Tableau Software, 2014). Geospatial data in forms suitable for quick entry into most of these visualization resources can be downloaded at no cost from the US Census Bureau's popular *American FactFinder* website (United States Census, 2014). The ready availability of this kind of data supports the publication of an endless variety of interactive maps, such as the "Racial Dot Map" of the United States. This particular map provides a visual representation of the "racial diversity of the American people in every neighborhood in the entire country" with a dot that is "color-coded by the individual's race and ethnicity" to represent each of some 308 million individuals (Cable, 2013).

Developments in the area of realistic three-dimensional (3-D) renderings of buildings within urban landscapes are expected to serve clients of real estate firms promising to assist in the selection of the "optimum living environment" (Rau and Cheng, 2013). One system in development "includes a 'Not in My Back Yard' (NIMBY) map" as "important layer used to depict facilities which people do not like to live in proximity to" (Rau and Cheng, 2013: 39). Again, only failures of imagination limit the variety of layers that might be included within someone's personalized NIMBY maps.

Indeed, the flexibility in map design has been advancing at such a rate that the trend toward personalization in informational resources will extend to "on-demand" customization of maps for mobile users. This kind of personalization means that no two "maps" need be exactly the same in the future (Parsons, 2013: 184).

## Institutional uses and users

Monmonier (2002) underscores the importance of location to marketers and political consultants who rely upon demographic, psychographic, and behavioral information about residents within neighborhoods in order to develop persuasive communication strategies based on variants of "neighborhood lifestyle segmentation" (141). While "geodemographic clustering" on the basis of public and privately sourced information at the ZIP code level of detail was of sufficient granularity for earlier targeting efforts (Goss, 1995), contemporary micro-targeting efforts routinely focus at census tracts, households and individuals characterized on the basis of algorithmic processing of information acquired from commercial data brokers (Auerbach, 2013; U.S. Senate, 2013).

Monmonier (2002: 154-168) identifies a number of other uses of geodemographic information to identify and evaluate the nature and extent of the risks that are thought to be characteristic of particular neighborhoods. Medical researchers have made use of GIS in support of "geographical epidemiology," including efforts to

investigate factors related to patterns of mental disorders within urban areas. These studies have explored the "association of neighborhood-level factors with stress, depression, psychosis, alcohol and drug use, and psychiatric admissions, discharges and disability" (Brown, 2013: 5). And, although conclusions about the true nature of the risks leading to mental illnesses like schizophrenia remain out of reach, it seems likely that geospatial data will play an important role in their pursuit.

The uses of "geovisualization" as an aid to strategic decision-making within business organizations and government agencies have expanded so rapidly that their classification actually represents a challenge to researchers seeking to describe its growth. And while there is certainly a legitimate basis for attempting to assess the contribution that geospatial data and analytical resources are making to the efficiency and effectiveness of decision-making efforts (Erskine, et al., 2014), it is even more important to evaluate the consequences that flow from present and future uses of the technology on this segment of the population.

Relationships between academic geographers and their widening audience networks invite both interest and concern about the production and use of "geographical knowledge" in settings with the potential to influence public policy and practice (Kitchin, et al., 2013). The development and use of GIS by individuals and members of community organizations has certainly expanded as a result of their efforts to shape public policy at the local level (Blaschke et al., 012; Elwood, 2006; Ganapati, 2011). Computer-assisted, or data-based journalists have considerable experience in using these resources in the development of critical insights that on occasion, actually lead to changes in local, regional and national policy (Houston, Bruzzese and Weinberg, 2002). It is not clear, however, whether the traditional role of investigative journalists is being transformed by the incorporation of computational specialists within news organizations who don't share their assumptions about the audience's need for analysis (Parasie and Dagiral, 2013).

## Popular access, use and abuse

Maps have become broadly accessible, in part because they are available online and, and through mobile devices. A billion people reportedly access Google Maps each month (Parsons, 2013). While not all of the geospatial data that people will access will be in the form of maps, as we know them today, some meaningful representation of a user's local context will become the dominant use of geospatial information in the near future (Parsons, 2013: 182).

Resource developers are continuing to develop applications for mobile devices that provide some kind of location and context based notification to the user (Garfinkle, 2014). Most of these notifications are meant to inform clients/subscribers about consumer-oriented opportunities located nearby, but a good many have been designed to warn travellers of risks within an environment, or along a route that

they have identified or appear to be following. In addition to facilitating "efficient" navigation to points of interest or engagement to consumers, many of these resources also identify dangerous or "unsafe" neighborhoods, and offer alternatives for bypassing them (Badger, 2013; Thatcher, 2013).

A variety of trademarked names have been generated to differentiate multiple versions of the kinds of "geofencing" services being offered. What these resources have in common is the manner in which a "virtual perimeter" is established around a person, place, or thing. The differences emerge with regard to their geospatial representation and the kinds of opportunities that are, or are not provided to individuals.

A recent patent application (Zeto, et al., 2013) described a system for delivering marketing content to a consumer's mobile device based in part on the consumer's location. It would also facilitate the redemption of "location-restricted offers" that would be tied to a particular location. While this particular system is designed to allow clients to specify the boundaries within which valid offers could be used, it is not to difficult to imagine future services that would restrict the supply of offers to only those individuals that fit within the "boundaries" of the kinds of consumers that the client would like to attract.

Again, as we noted with regard to the nature of adverse impact discrimination, exclusion from a commercial opportunity would certainly not be made explicitly on the basis of membership in a protected category. However, if in the same way that civil rights organizations developed research strategies to gather evidence of racial profiling along the nation's highways (Harris, 2002), researchers concerned about inequality could use analyses of TGI in order to expose patterns of exclusion that would at the very least be embarrassing to the enterprise if revealed, even if they might not justify sustainable legal action.

What is not so clear is whether there would be the same kind of negative public response if the denial of special offers was based on the massive amount of TGI, including search and social network interactions, that supports the microtargeting of consumers (Auerbach, 2013). As one provider describes the nature of "programmatic buying" in terms of advertisers that "buy impressions individually, not grouped by the thousands or millions. Each ad marketplace auction allows an advertiser to serve one specific ad to one single customer in one single context" (Siebelink and Belani, 2013: 4).

The ability of marketers to target uniquely identified individuals has increased substantially on the basis of the "mobility traces" being generated by user devices (Montjoye, et al., 2013). Unfortunately, this form of discrimination will be difficult, if not impossible to assess in terms of its disparate impacts.

Mapmaking is also being used as a resource for participatory expression of individual and collective perspective on places and the relationships that exist

within them (Blaschke, et al., 2012). The increase in "volunteered geographic information" that includes geo-tagged images and even "snippets of text" that become available for collection and analysis raises a host of new privacy and surveillance concerns related to how individuals, and the places in which they spend time are made available to others (Elwood and Leszcynski, 2010). It is suggested that in the emergent GIS-enabled environment "identification and disclosure are more immediate, and less abstracted than in, say, a numerical database. In the case of digital images, whatever is revealed is underwritten by the primacy of 'truth power' afforded to visual artifacts" (Elwood and Leszcynski, 2010: 13).

## Placemaking and GIS

Placemaking involves the social construction of an identity that comes to be applied to the people, places, and things (including experiences) that are believed to exist, or to occur within a geographically and spatially defined boundary. Placemaking is associated with mapping and GIS technology because of the role that maps play in the specification of the boundaries and the representation of the attributes that are used to justify the use of particular identifiers or labels.

The characteristics of neighborhoods, or even of the places within a half-mile radius of some point or street address can be used to generate an assessment of a place in terms of its "walkability" (Kramer, 2013). A half-mile radius from some center point is treated as equivalent to a 10-minute walk, although actual walkability will vary considerably from place to place.

Similar assessments of the people within geopolitical spaces, such as those defined by the US Census bureau can be used to describe them in terms of the probability of their communicative interaction or encounters with each other as predicted on the basis of their estimated "social distance" (Tita and Radil, 2010: 471). As a result we have learned that chance interactions that have the potential to develop into mutually beneficial social ties are more likely at the points at which tertiary streets intersect (Tita and Radil, 2010: 475) and at public transit stops.

As we have already noted, a great many of these attributes are predictions about the likelihood that particular kinds of opportunities or threats will present themselves in the relevant future. While this identification is necessarily spatial, its core is contextual because its emphasis is on activity or behavior. The identification of places as being "dangerous" can be based on an assessment of a variety of risks ranging from natural disasters such as earthquakes and floods to a host of other threats associated with the actions of others such as automobile accidents, violent assaults, or thefts of property. The estimated risk of crime is a primary determination of the perceived, or calculated, dangerousness of a particular place.

Of course, not all risks are easily standardized for comparisons or incorporation into a summary index. This is due, in part to a recognition that particular locations, at particular times of the day or week might include higher levels of risk as an aspect of their attractiveness. This is certainly the case with alcohol-centered nightlife/entertainment districts that exist as employment centers during the day (Liempt and Aalst, 2012).

## Naming and boundary setting

Marketing and other forms of communication about a place depend to a considerable extent upon the names that are used in reference to it. GIS plays a central role in the definition and naming of the places in which people make their lives. These names often provide "clues" about the socioeconomic identities of these people. The sources and kinds of data being used in support of this naming continue to expand.

For example, the analysis of images from social media sites is helping to add social categories to the spatial coordinates that are increasingly being linked to those images. A high level of early success in assigning images of people from group photos to one of 11 "urban tribes" has been reported. The authors (Kwak et al., 2013: 2) suggest that the ability to automatically assign people to their social categories will improve both marketing strategies and the "surveillance of social demographics." While this early work has discovered that it is more difficult to assign group members to some categories like "hipsters" than to others, like "goths," they appear confident that the accuracy, or performance on "ground truth" tests will improve as the pool of reliably classified images increases.

The raw material available for training these algorithms is expanding exponentially with in excess of 300 million images being uploaded to Facebook each day, and additional image-based apps for use with mobile devices will undoubtedly add to this wealth of visual data (Ambrust, 2012).

## Public participation

Despite the fact that public participation in development planning has become a formal requirement by government agencies, especially when they are providing financial support, there is a general sense, at least in the United States, that many of traditional methods do not work very well (Innes and Booher, 2004). To some extent the failure of these efforts reflects a poor match between the purpose, or goals of public participation and the methods used to achieve them (Shipley and Utz, 2012). While many of the goals are related in some way to the others, there are important differences between informational goals and those related to fairness or social justice, and more strategic goals that involve the search for legitimacy and support for decisions that may have already been taken by elites (Smith and Floyd, 2013).

Truly collaborative participation between planners and the general public is an ideal that is far from becoming the norm, although there are a few examples of success. Elwood (2006) tells the story of how two community organizations in Chicago neighborhoods made use of GIS to generate spatial narratives about their communities in ways that afforded them considerable influence over plans and policies that would govern the revitalization of the areas they called home. They were able to make use of GIS technology to "produce a variety of accounts and interpretations of neighborhood conditions, needs, goals and activities" (Elwood, 2006: 332). These various narratives were often directed toward government agencies and foundations in order to garner support for projects, but they were also produced in support of the organizations' claims of status and legitimacy as representatives and advocates of their communities.

Elwood (2006: 336) notes that participants in "organizations contend that the actors and institutions with whom they negotiate are likely to understand these maps as presenting an unassailable truth about a place." And, they suggest that these presentations help to "bolster the legitimacy of their claims and to cast themselves as knowledgeable skilled actors in neighborhood decision making." Without denying the fact that these organizations are not as powerful as other agents acting in this policy arena, Elwood emphasizes the fact that those who have been previously marginalized have become more active and influential participants in an evolving policy environment.

The involvement of the general public in determining the nature of development and growth within their communities has introduced a number of important insights and changes in the manner in which plans are developed and implemented (Shipley and Utz, 2012). Planners have discovered that residents' perceptions of the nature of their communities, including its boundaries quite often differ from those used routinely by the experts (Coulton, Chan and Mikelbank, 2010).

When community members in 10 cities in the US were asked to name their neighborhoods and use a GIS resource to draw its boundaries, only a small proportion of the participants used the same name that was being used for a community development initiative. This study "found that even among residents living in close proximity to one another, there were a number of divergent opinions about neighborhood names, sizes, and boundaries" (Coulton, Chan and Mikelbank, 2010: 22). Many of these differences appeared to be influenced by housing tenure patterns, as well as by racial and ethnic differences in the population.

What remains to be seen in terms of the impact of differences in naming and boundary construction is the extent to which engagement and commitment to the planning initiative is affected by a mismatch in the names used by planners and officials and those used by the residents of a target area.

## Transportation and "Smart Growth"

"Smart Growth," "New Urbanism" and "Transportation Oriented Development" are just a few of the constructs that have been introduced as aids to the promotion of what many see as "progressive" planning efforts meant to achieve some level of environmental sustainability. The somewhat compelling logic within these strategies is that by increasing population density within the urban core while limiting suburban sprawl with the aid of enhanced public transportation, a host of environmental harms associated with the generation and release of greenhouse gasses (GHG) into the atmosphere will be minimized (Kramer, 2013).

Activism on the part of governments at the national, state and municipal level has raised objections from some corners where regulatory constraints on development are viewed as an untenable infringement on free market liberties. There is considerable uncertainty and debate about whether any of these planning initiatives will actually achieve the laudable goal of environmentally sustainable growth (Neuman, 2005). There is far less concern about the impact of that these initiatives will have on poor and minority communities, but it continues to be expressed (Kushner, 2002-2003), occasionally within the context of questions about the place of equity within debates about sustainability (Gandy, 2013).

A primary source of concerns about equity is with regard to the process of gentrification (Godsil, 2014; Pollack, et al., 2010). As Kushner (2002-2003: 67) sees it, under gentrification, "a consumer preference for urban living causes developers to increase rents, displacing the poor into a dwindling supply of decent housing, resulting in landlord exploitation, excessive rent costs, overcrowding, or the outright expulsion from the city or entry into homelessness."

Transportation Oriented Development (TOD) represents an especially important focus of concern because of the highly disruptive impact of alterations in a city's transportation infrastructure. As it is generally understood, TOD "locates housing, shopping, and employment near transit stations. It makes transit a more convenient and practical form of transportation and can be a catalyst for other land use changes that benefit the environment" (Kramer, 2013: 83).

While many of these changes are likely to be of benefit to investors, "more disadvantaged communities may fail to benefit, if the new development does not bring appropriate housing and job opportunities, or if there is gentrification that displaces low-income and/or minority residents" (Chapple, et al., 2013: 5). This displacement often occurs because "a new transit station can set in motion a cycle of unintended consequences in which core transit users—such as renters and low-income households—are priced out in favor of higher-income, car-owning residents who are less likely to use public transit for commuting" (Pollack, et al., 2010: 1). It is the extent to which these exits from the neighborhood are non-consensual (Godsil, 2014: 2), rather than an exercise of unconstrained autonomous choice of the sort

that neoliberal models of development assume, that raise concerns about the negative impacts of TOD.

## Transit corridors

A series of case studies by the Center for Transit-Oriented Development (The Center) have presented the case for encouraging economic development around public transit stations, and they have focused their attention on the social, economic, and environmental impact of these initiatives. At the heart of their analysis is an examination of the "transit corridor," or the "walkable areas around all of the stations along a transit line," typically these corridors are described by a half-mile radius around each of the stations" (Thorne-Lyman and Wampler, 2010: 4).

Increasing regional and local equity has been identified as one of seven objectives of corridor-focused TOD. They note that connecting "lower-income neighborhoods to job centers enhances equity by increasing access to jobs and economic opportunity and by reducing transportation costs for residents, which allows them greater spending power." But, they also note "residents who live in these places can be displaced when rents and housing prices increase. This risk is particularly great in older neighborhoods that are built out and have limited land available for new housing"(Thorne-Lyman and Wampler, 2010: 16).

The Center, and other organizations concerned with TOD suggest that in order to realize the equity goals that should be part of these initiatives, early planning has to be based on an analysis of existing conditions, not the least of which includes "the median income of residents, educational attainment, percent of renter households, and age of housing stock" (Thorne-Lyman and Wampler, 2010: 17).

While The Center includes concerns about equity within its planning criteria, other planning organizations, such as PolicyLink make "advancing economic and social equity" a central focus of their research and action initiatives. The PolicyLink Center for Infrastructure Equity (PolicyLink, 2014) includes transportation as policy focus. In their analysis of TOD policies in Saint Paul, Minnesota, PolicyLink provided a "Health Impact Assessment" (HIA) of the light rail project designed to connect downtown Minneapolis with downtown St. Paul. HIA's are designed to judge "the potential, and sometimes unintended, effects of a policy, plan, program or project on the health of a population and the distribution of those effects within the population" (Malekafzali and Bergstrom, 2011: 11).

While TOD projects often involve zoning changes, usually designed to increase the development potential of properties within the corridor, increasing this potential "could result in commercial and residential displacement if property values and rents rise above sustainable levels for current tenants" (Malekafzali and Bergstrom, 2011: 13). The PolicyLink team identified a number of related paths through which zoning changes could have negative impacts on neighborhood livability and health.

They also identified 50 indicators that were to be used to describe current conditions within the "Central Corridor," as well as to identify and illustrate some of the ways that rezoning might affect members of the community.

In the case of TOD planning in Phoenix, Arizona, a somewhat different approach has been taken. While "overlay zoning" of specific areas within the transit corridor is somewhat common, the strategy in Phoenix was unusual in the degree to which the creation of these zones preceded the construction of a light rail system in order to accelerate land use change and economic development (Atkinson-Palombo and Kuby, 2011: 190).

A retrospective analysis sought to associate the characteristics of segments of the corridor that were, or were not subject to overlay zoning, with the dollar value in the development around stations between 2000 and 2007, and before the system went into operation in 2008. Despite the fact that areas defined as "Urban Poverty" segments had a high proportion of vacant land, and "a need for urban revitalization," they did not attract much advance development.

Although the Urban Poverty segments that did receive overlay zoning received substantially more new construction than those that did not, most of those areas did not receive this zoning. The overwhelming source of development within these areas was publicly funded condominiums. This pattern was consistent with those observed in the past where "development generally takes place in the most desirable locations first, and once they become built out, developers rotate to neighborhoods that were initially less desirable" (Atkinson-Palombo and Kuby, 2011: 198).

Advance planning that does not provide subsidies and enhancements designed to improve disadvantaged neighborhoods all but ensures that the extent of the disparity between segments will increase (Franklin and Edwards, 2012).

## Identification of segments

Transportation corridors tend to be discussed in terms of the areas surrounding the stations or "stops" along the transit path. However, these stations exist within communities or neighborhoods that have their own identities, largely independent of those stops. Planners often engage in significant placemaking activity in relation to the recasting of those segments in terms of a commercially salient identity. In its recommendations to transportation planners in Los Angeles, the Urban Land Institute explicitly recommended that they "brand each corridor" and identify assets near each station. They also suggested that this branding should encourage development "that is culturally and contextually responsive and selective" (Urban Land Institute, 2013: 3).

Wood and Ball (2013) have already helped to frame the implications of the "spatial construction of brandscapes." As they see it, "the brandscape has come to represent

a climax vision, a utopia of neo-liberal capitalism, which brings together hyper-consumption, personalization, niche marketing, lifestyle choice, just-in-time production processes, the ubicomp revolution and surveillance practices" (2013: 49). Although their analytical focus is primarily on the consumer experience, it should be clear that this process has vitally important consequences for the residents of those spaces being continually reconfigured for consumption (or avoidance) by particular categories of consumers.

In the Central Corridor Development Strategy assessed by PolicyLink, five "submarkets" were identified on the basis of "their real estate potential—and determined by their different land use characteristics and demographic profiles" (Malekafzali and Bergstrom, 2011: 22). Impact analyses identified which of these submarkets were likely to benefit, and which were likely to suffer as this "strategy" is put into operation. Of particular significance is the identification of the areas in which features indicative of "gentrification" were most likely to emerge (Malekafzali and Bergstrom, 2011: 65-68). Risks to pedestrians and other health impacts were also described and discussed in relation to these different parts of the Central Corridor.

## Examining public participation in transportation planning

A central part of the transportation planning initiatives that emerged near the turn of the last century in the United States was the involvement of a host of different "stakeholders" in the process of developing a "vision" of an idealized system, and a "blueprint" for implementation of the plans that were expected to emerge through their efforts (U.S. Department of Transportation, 2010). These new "partners" included land use and transportation planners, many of whom worked in local, regional and state governments, as well as elected officials from local jurisdictions. They also included representatives from organized interest groups, many of which, like developers and environmentalists, saw each other as opponents, rather than partners (Barbour and Teitz, 2006). Traditionally excluded or marginalized stakeholders, such as members of the general public without residential property interests who tended not to be involved in neighborhood organizations, were also expected to be included in the deliberative process.

Although this more inclusive planning process varies dramatically across regions, it was generally expected that some version of a preferred "growth scenario" would emerge as the basis for land use and transportation planning for the future (U.S. Department of Transportation, 2010).

### Experts and indicators

A great many of the struggles and disappointments that emerge within communities that have engaged in transportation planning have a basis in the need to choose a specific indicator or operational definition of the performance goals associated with

a particular design or policy choice. If we consider that one of the primary goals of smart growth TOD is a reduction in air pollution and GHG emission by reducing travel by private automobiles, then a reduction in "vehicle miles travelled" or VMT is a measurable goal with reliably gathered data.

This goal is often in conflict with a tendency among traffic engineers to rely upon car-focused measures of "intersection level of service" (LOS) easily understood and measured in terms of traffic delays that motorists experience during peak commuting hours (Henderson, 2011). Ongoing debates about the relationship between increasing LOS and VMT have been informed by research that generally concludes that reducing the "costs" of driving by expanding roads and traffic lanes increases both demand and VMT (Kramer, 2013: 28).

An emphasis by experts on maximizing LOS privileges street designs that "coupled with lower densities, makes walking and cycling dangerous, and transit impractical. This in turn increases VMT, energy consumption and pollution…" (Henderson, 2011: 1140). Yet, as Henderson notes in the case of transit planning in San Francisco (2011: 1144), efforts to overcome the seeming irrationality of reliance on LOS may require acceptance of neoliberal pricing strategies and concessions to developers that are likely to have troublesome consequences for the more disadvantaged segments of the population.

### Officials

We are reminded (Jun, 2013: 323) that elected officials within municipalities exercise power in a variety of ways that can result in critical transformations, or change in the character of neighborhoods or communities. Zoning and municipal ordinances readily come to mind, but the provision of official support for needed public services "can prevent neighborhood decline or promote revitalization," whereas, quite the opposite result is likely to follow its denial over time.

An initiative to implement TOD in the Los Angeles Metro area emerged followed voter approval of a multi-billion dollar increase in investment in support of fixed-guideway transit projects in Los Angeles County. The Mayor of the city established a "TOD Cabinet," largely composed of transportation "experts" who would play a leading role in developing the "Transit Corridors Strategy." The initial process involved the identification of transit orientation "goals and values." In addition of environmental sustainability, the values included fostering "equal access to opportunity and equitable treatment for all" (Carlton, et al., 2012: iii).

Because the logic behind the planning initiative was the identification of tactics that would support achieving measurable objectives that reflected the region's goals and values, it became possible to evaluate how many of the 172 tactics identified in the early stages were actually related to achieving particular objectives.

For example, 58% of the tactics were deemed relevant to reducing "reliance on the automobile," but only 9% were relevant to the goal of involving "the community in the transformation of their city," or in improving the "quality of life in existing single-family neighborhoods" (Carlton, et al., 2012: 75). At the same time, in an assessment of the tactics that related to the four values, we observe that the smallest, though still high proportion of votes (85%) was captured by equity. With regard to the relationship between tactics and the four goals, employment opportunity, or jobs was the lowest in representation (65%) among the four (Carlton, et al., 2012: 76).

There are substantial differences across metro areas in the US in terms of the jobs that are accessible through public transit. It is especially problematic when transit service to high-skill jobs exceeds levels of accessibility to low- and middle-skill jobs. This pattern is reflective of the tendency for workers in low-income suburbs needing to travel great distances to reach the jobs for which they are qualified (Tomer, et al., 2011).

Public officials are frequently challenged by the need to make difficult choices among competing goals or objectives. This is especially true in the case of decisions about public transport, where fiscally conservative interests emphasize the need to ensure routes and services are efficient, serving the greatest number of paying passengers, and covering as much of the cost of service delivery through fares as is possible. These "patronage" goals are in direct conflict with interests that tend to frame public transit as a public service obligation, especially to those segments and areas of the population where the costs of meeting their transportation needs exceed users' ability to pay (Walker, 2008). Transportation planning documents increasingly make reference to equity concerns, but the selection of indicators still tends to emphasize concerns about efficiency (Seattle, 2012).

### Stakeholders

A classic example of conflict between stakeholders can be seen in the case of Ogden, Utah's experience with TOD. One group in support of private development attempted to generate support for developing the region's winter sports business with the addition of a gondola serving an existing ski resort. A community group identified with "smart growth" developed in opposition to the gondola and in support of a streetcar (Dorsey and Mulder, 2013). Not surprisingly, conflict among the various interests within and outside of government has meant that progress toward a decision has been slow, and while support for the gondola proposal "faded away," very little progress has been made toward reaching consensus and finalizing plans, or in acquiring the financial resources that would be needed to build a streetcar (Dorsey and Mulder, 2013: 72).

Among the problems associated with including members of traditionally marginalized publics in deliberations about TODs are those related to overcoming the language barriers common to many members of immigrant communities. Failing

to include members of these communities early in the planning process makes it likely that questionnaires or interview schedules that have been designed to capture the public's preferences for particular transportations services will not even include many of services that are most important to this group. This is a special case of the problems that emerge when the public is not included in early discussions about the kinds of information that surveys are supposed to gather (Schachter and Liu, 2005).

Although the Urban Land Institute in Los Angeles recognized the importance of including members of the affected communities in the planning of their transit corridors, they admitted that their own planning report "does not provide adequate opportunity for input from the people most impacted by the recommendations." So, they "urged the city" to "fully integrate the public into the process so that we all move forward toward a common objective with a clear consensus on our vision" (Urban Land Institute, 2013: 25).

## Blind spots, assumptions and false starts in Tucson

The city of Tucson, the largest municipality in the Tucson Metropolitan Area has the distinction of being the sixth poorest large city in the US, despite its historical and projected growth in physical size and population. Unfortunately, Tucson also has a recent history marked by considerable tragedy and suffering, largely felt by members of its sizeable Hispanic community, as a result of redevelopment planning decisions implemented in support of "urban renewal." A well received history of the Pueblo Center Redevelopment Project (Otero, 2010) describes the process through which the Mexican American residents of the La Calle neighborhood were displaced as their homes were demolished in order to be replaced by the La Placita Village and related government, business, and entertainment construction.

As Otero (2010: 9-10) saw it, "those who had the power to dictate space and the future took the opportunity to reinterpret the past and institutionalize specific historical memories. As bulldozers leveled sections of downtown, some took this as an opportunity to construct new historical narratives to reinforce claims of Anglo dominance and exceptionalism."

The demolition that began in 1967 in the Barrio and Presidio neighborhoods saw the destruction of some 319 homes and more than 1,000 residents "forcibly relocated. A unique three-plaza settlement was lost. A crime of incalculable cultural loss was finally completed" (Gomez-Novy, and Polyzoides, 2003: 4).

A somewhat different, but still related set of concerns about participation and development planning in Tucson have emerged with regard to a special development district established to facilitate downtown planning with financial support from sales tax revenue. The Rio Nuevo Multipurpose Facilities District has been the focus of considerable public criticism, much of it identifying official

corruption as the cause, but nearly all sharing the conclusion that the city wasted in excess of $230 million.

A "performance and financial analysis" by an independent consultant that concluded that the District had failed to develop the Tucson Convention Center (built on the site of the former La Calle neighborhood) as the economic catalyst it was expected to be, participated in planning for projects outside the District, and failed to complete many of the projects that it began (Smith, 2010). The report concluded that "the District's multi-destination strategy resulted in funds being spread too widely and too thin and missed the economic leveraging tools to bring in not only tourist dollars but a significant anchor to attract development dollars that follow" (Smith, 2010: 42).

## Plan Tucson

Concerns about the failures in planning and implementation in the Rio Nuevo District came to dominate the city's efforts to prepare a long range-planning document required by the State of Arizona. The city's voters had ratified the last General Plan in 2001, and the city initiated efforts to update that plan in 2011. While voting for a plan might have served to meet public participation requirements in the past, state regulations insisted that "effective, early and continuous public participation" in plan development "from all geographic, ethnic and economic areas" of the city needed to take place (Tucson, 2011: 1).

Tucson's public participation plan was quite detailed, and in addition to the general public, identified several categories of internal and external "stakeholders" that were entitled to facilitated access to information and discussion about most aspects of the planning exercise. Neighborhood and homeowner associations, as well as environmental and social services groups were explicitly included within this group of stakeholders (Tucson, 2011: 5).

Stakeholder orientation meetings were organized in three categories, Socioeconomic Prosperity, Environmental Integrity, and Smart Growth, that were designed to gather input from participants that were especially interested in these aspects of a long term plan. In addition, a number of specific working groups were also created as a way of generating information and insight as the planning effort progressed.

It is worth noting that even though the title page of the planning document included "Equity" as one of the three themes of the effort, the others being Prosperity and Integrity, the initial set of categories and elements identified within the goal of Socioeconomic Prosperity did not include equity as an element worthy of measurement (Tucson, 2011: 11). The impermanence of equity as a primary concern among Tucson's planners would become a focus of explicit criticism as the planning effort moved forward.

Representatives of the city had been active participants in the development of the STAR Community Rating System (STAR Community, 2012) that was to be used to help communities across the nation assess their progress in achieving sustainability goals. The STAR Rating System included "Equity & Empowerment" as a central feature of its evaluation strategy. However early drafts of Plan Tucson included reference to the STAR system and its evaluation measures without including that component among the proposed indicators to be used locally.

In May of 2013, a group of organizations representing the interests of developers in the region wrote a letter to the Planning Commission essentially reminding the city what this exercise really was supposed to be about. They noted that while "our members recognize the importance of social justice and environmental issues to future sustainability, we believe it is essential for Plan Tucson to prioritize business initiatives, private investment advocacy, job creation and economic sustainability" (Tucson, 2013a: 19). The following month, the city's planning department recommended that the Mayor and Council not adopt the Plan in its current form, in part because they felt that the plan "could polarize the community and is not likely to have adequate support for voter ratification" (Tucson, 2013b).

While a great many factors combined to force the recasting of this comprehensive plan, including the active engagement of organized neighborhood groups, the finally approved version barely mentioned STAR and its evaluative criteria. More critically, the final approved plan didn't include a single mention of inequality as a concern (Tucson, 2013c).

### Broadway Corridor

In 2011, the Tucson metro area was identified as the 25th "most dangerous large metro areas for pedestrians" (Ernst, 2011: 11) on the basis of an index that takes into account the amount of walking that actually takes place within these areas. Taking into account the fact that Hispanics and African Americans "on average, drive less and walk more than other groups" (Ernst, 2011: 17-22), it is reasonable to assume that these segments of the population are at comparatively higher risk. The same is true for the poor, senior citizens, and young children. Members of these groups are especially likely to be at higher risk in those areas in which transportation planning does not take their needs into account. This is generally the case when transportation planning is focused on the mobility of private automobiles, rather than that of pedestrians or bicyclists.

A planning exercise for the expansion of a short segment of Broadway Boulevard, a major "arterial" that was supposed to be "improved" in support of further development of the downtown area stands as an example how citizen participants struggle as they attempt to recast transportation designs in the interest of the residents of the neighborhoods through which a major roadway passes. A Public Participation Plan included the establishment of a "Citizens Task Force" (CTF) that was supposed to represent regional and local interests.

However, As Otero (p. 123) noted, participatory planning exercises may have an intensely local focus, but the implementation of these plans generally have a broader impact. As a result, those who exercise power from locations beyond the neighborhood often tend to minimize the influence of those making their lives within (Jun, 2013: 325).

At one of several "large-scale public meetings" planned to inform participants and gather their preferences for "street width design alternatives," fully 78% of the participants who provided their home address lived within one mile of the project corridor (Tucson, 2013d: 2). Although this part of a $2.1 billion voter-approved regional transportation plan was supposed to "create a street design that best meets the needs and goals of all the local and regional communities that this section of Broadway Boulevard serves" (Tucson, 2013d: 2), it was quite clear that the majority of the participants in this process thought of this segment as a "destination" rather than a conduit in support of downtown and regional development, or as a subsidy for suburbanites who drove into town each day.

Although the performance measures developed by the CTF and project staff included a variety of concerns that included the safety of pedestrians and bicyclists, the effective movement of vehicular traffic through the corridor was also included among indicators to be considered by the workshop participants. They were asked as individuals and members of groups at separate tables to select street cross-sections that best met the evaluative criteria that they had selected. The impact of the overwhelmingly local presence at these tables was reflected in the fact that "traffic movement" was selected as important by only 9% of the tables, while "historic and significant buildings" was selected by 20% of the tables. Not a single table selected "transit travel time" as one of their most important design considerations (Tucson, 2013d: 20).

Discussions during the workshop explicitly considered "tradeoffs" between transportation and place-based concerns. Overall, in the discussion of these tradeoffs, "groups largely came down on the side of the place measures" (Tucson, 2013d: 57). People seemed willing to trade off automotive mobility against what they understood as the potential for local economic development. It seemed to project staff that the participants "saw a direct adverse effect of more lanes and traffic on the sense of place along Broadway" (Tucson 2013 d: 61].

This hyper-local emphasis on preservation of the qualities of the neighborhoods, including their historical structures was also reflected in their selection of their preferred cross-sections that were "the narrowest in terms of right-of-way width" (Tucson, 2013d: 39).

The response to this expression of a local community's reluctance to transform their neighborhood into a conduit and thereby accept the accompanying noise, pollution, and risk to pedestrians and cyclists from those acting at a regional level was loud

and clear. “In a brief, terse memo, Huckelberry [Pima County Administrator] announced that the county might withhold its $25 million contribution to the $71 million project, if the citizens task force now hashing over the design doesn’t stick to notions of a six-lane, median-divided behemoth coursing through the middle of town” (Vanderpool, 2013).

This conflict between members of the neighborhoods along a two mile strip and the far larger number of voters within the county that voted for an expansion of that road seems unlikely to be resolved in a manner preferred by those actively engaged neighbors.

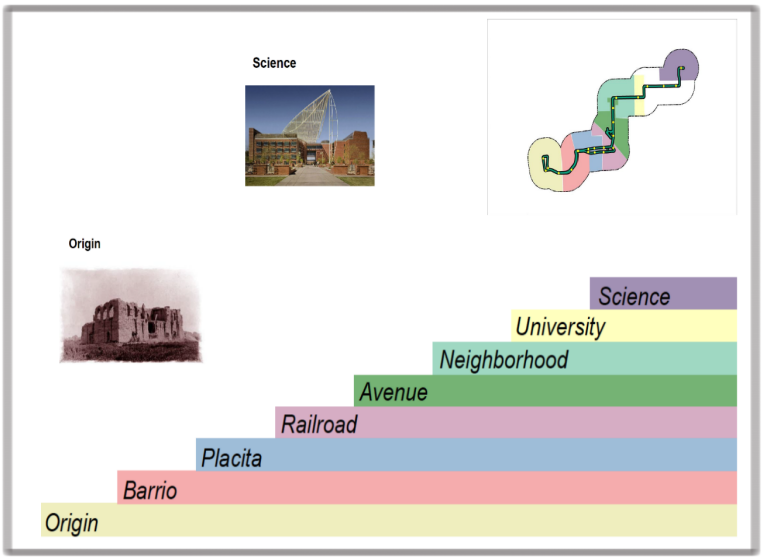
## Tucson’s Modern Streetcar

The last example of public participation in transportation planning involves an effort to derive maximum benefit from an investment in a “Modern Streetcar”—a four mile route designed to connect the University of Arizona (UA) and its medical facility with a popular commercial district, a largely government dominated downtown (Urban Land Institute, 2013a: 10) and a western “redevelopment” area. The project received preliminary approval from the Federal Transit Administration in October 2008.

Beyond the design efforts focused on system engineering, there was a significant commitment to “urban design” through a process that included “public participation” along with “environment and sustainability” and “public art” among more traditional concerns. Station design considerations were to be sensitive to “context” that was to be defined for neighborhoods, districts and significant “other places” along the four mile route. The goal of public involvement was “to realize a sense of ownership and community pride” through “recognition of communities and interests.” A Community Liaison Group, with representatives from five “major activity centers” along the streetcar route was established in 2004. One of its purposes was to “Gain community understanding and support” (Tucson, 2004: 4). The focus of the design strategy changed continually, with the University of Arizona (UA) and 4th Avenue/Downtown becoming part of a four station area focus by 2008 (Tucson, 2008: 8).

The results of these ongoing streetcar design meetings were presented to the general public for comment in January 2013. Once again, an analysis of comments of participants in a public process that involved interactions with more than 650 individuals and identified a large number of themes. The analysis indicated that the most frequently expressed concern was about “Character/Historic Preservation/Heritage and Culture,” (n=73). “Economic Development” (12), “Gentrification and Social Justice” (10) and “Development/Redevelopment Opportunities” (8) were among the least often expressed concerns (Tucson, 2013: 21).

## Identifying Segments




A central part of that public presentation was an examination of the rationale behind the identification of eight different segments as "character areas." It is worth noting that the presentation began with the westernmost segment because of it status as the historic "Origin" of the city, moving eastward through the "Barrio" to the recently transformed "la calle" neighborhood, now named "La Placita." After passing through a not otherwise named "Neighborhood" segment, the line entered "University," ignoring the unnamed "Campus" segment, and ending with "Science." More detailed information including "streetscape" designs under development for subsections or districts along the route were also presented (Tucson, 2013).

## Choosing a Corridor Radius

The planning materials were focused on design concepts for the areas surrounding the streetcar stops or "stations." The most common areal specification for the analysis of status and outcomes for neighborhoods surrounding transit facilities is a ½ mile radius, which is assumed to be the greatest distance individuals are willing to walk to reach a transit stop (Guerra, Cervero and Tischler, 2012). Arguably, a ¼ mile radius might be sufficient for predicting ridership, but it is likely to be a poor basis for predicting the impact of socioeconomic developments that follow investments in urban transportation systems. Unfortunately, the early planning documents used for Tucson's Modern Streetcar project focused on a ¼ mile radius for zoning, land use planning and design initiatives.

Such a decision, by accident, or by design, excludes a substantial portion of the population likely to be affected by the introduction of a new or improved transit system and associated development of corridor streetscapes and resources.

Using US Census data provided by the Center for Transit-Oriented Development (CTOD) for each of the 21 stations initially proposed and approved for the Tucson system, I made several comparisons between ¼ mile and ½ mile radius corridors around those stations to assess what differences would emerge.

### Paired Comparisons

**Difference in the means between ¼ mile and ½ mile corridors**

| Variables | t | Sig. |
|---|---|---|
| H&T costs as % of income | 2.884 | 0.009 |
| % with Bachelor's degree | 0.697 | 0.494 |
| Jobs/Acre in 2004 | -1.858 | 0.078 |
| Jobs/Acre in 2009 | -1.988 | 0.061 |
| MHI in 2000 | 3.848 | 0.001 |
| MHI in 2009 | 0.585 | 0.565 |
| MHI change | 0.814 | 0.425 |
| % Hispanic in 2009 | 0.322 | 0.751 |
| % Renters in 2009 | -1.745 | 0.096 |
| Population change | 0.814 | 0.749 |

Ten variables were selected from the CTOD database (Center, 2014) on the basis of their potential for identifying the characteristics of neighborhoods likely to be transformed through gentrification. A comparison of means between these corridors at the overall system level indicated that a number of differences between them were quite substantial. The greatest differences were in terms of Housing and Transportation costs (t= 2.884, p= .009), and Median Household Income (MHI) in 2000 (t= 3.848, p= .001).

While differences between corridors at the system level might contribute to our understanding of the impact of analytical frames in general. However, it tells us relatively little about the differences that are likely to emerge within individual neighborhoods, or communities that are directly affected by transportation-related designs.

We noted, for example, that there were already dramatic changes in the populations surrounding the 21 proposed stations between 2000 and 2010. Using a fairly conservative measure of difference between ¼ and ½ mile corridors (>30%), the

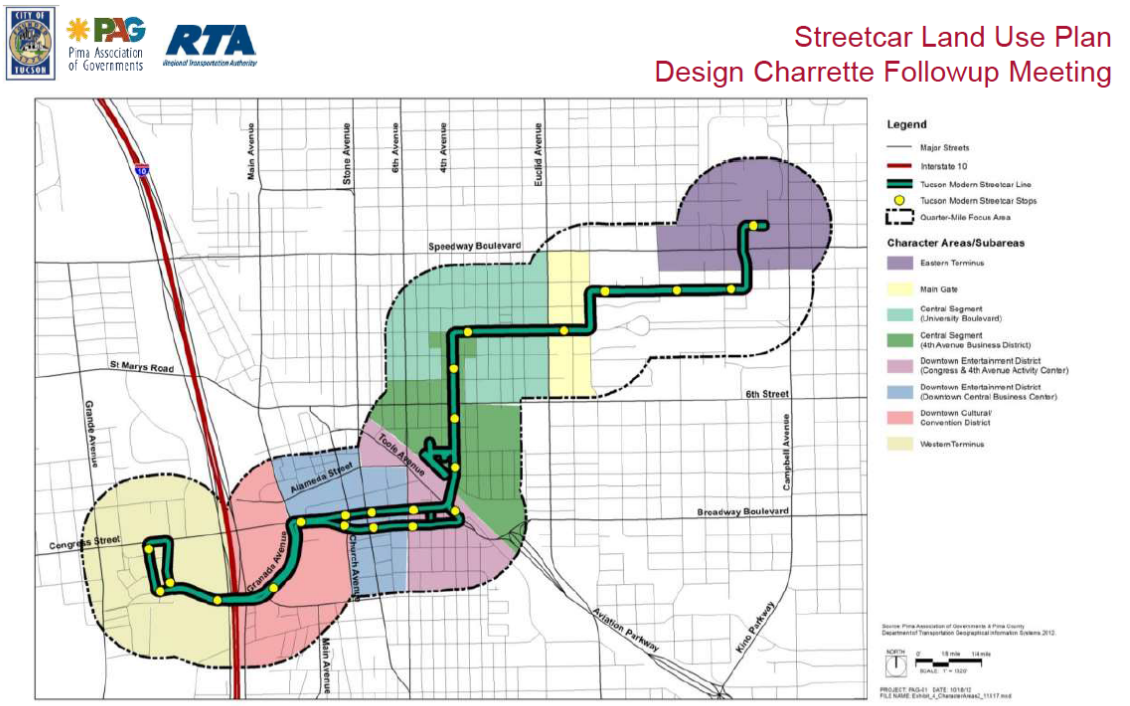
populations around nine of those stations changed quite substantially. While the greatest differences between corridor estimates were in areas near the university, there were also great differences in estimates of population change in the Western region, where the majority of residents were Hispanic.

On the basis of the observed differences at the station level, an analysis of differences between corridors was then produced in terms of the "character areas" or segments that had been identified through the "design charrette" planning process. Although the 2013 public presentation did not refer specifically to the core university segment (it was left white in the graphic below), it was included in a comparison of means between station corridors. Eight of the variables used in the system level comparisons were used in this analysis: 1) Typical housing and transportation costs as a percent of household income; 2) Percent of residents with Bachelor's Degrees; 3) Percent of residences that are renter-occupied; 4) Number of jobs per acre in 2009; 5) Median household income in 2000; 6) Median household income in 2009; 7) Percent of the population Hispanic or Latino; and 8) Change in Median household income between 2000 and 2009.

Analysis of variance was used to assess the differences between segments for the ¼ mile and ½ mile radius corridors around stations. Differences across segments were highly significant ($p < .01$) for five of the eight measures taken at the ½ mile corridor level. Only two, MHI2009 and MHIchange were not significant. The greatest differences were seen with regard to Percent Hispanic ($F = 47.765$, $p = .000$), Jobs per acre [$F = 31.863$, $p = .000$), and Percent Bachelor's degree [$F = 21.379$, $p = .000$).

Differences across the ¼ mile segments were highly significant ($p < .01$) for all eight measures. The greatest differences were seen with regard to Percent Hispanic [$F = 92.123$, $p = .000$), and Jobs per acre [$F = 73.377$, $p = .000$). While the differences in Percent Bachelor's degree across segments were highly significant, it was substantially smaller than differences observed at the ½ mile radius [$F = 6.321$, $p = .003$).

By sorting these comparisons on the basis of "character areas" that had at least two stations identified within, it was possible to explore these differences more closely.




*Streetcar Corridor Character Areas*

For the three stations on the main campus (uncolored map segment), median household income in 2009 differed significantly (t= 4.455, p= .047), and approached significance for the number of jobs per acre (t= -3.504, p= .073).

Understandably, when we move westward, the number of differences between corridors increased. The corridors surrounding the two stations in the Railroad segment differed significantly in three comparisons: Percent with Bachelor's degrees (t= 17.862, p= .036), Percent renters (t= -23.475, p= .027), and jobs per acre (t= 43.089, p= .015). Three additional variables related to median household income (MHI) achieved significance at the .10 level: MHI2000, MHI2009, and change in MHI.

Similar patterns of difference were observed across the four stations identified within the Placita segment. Housing and transportation costs (t= 4.246, p= .024), percent renters (t= -5.619, p= .011), jobs per acre (t= -17.269, p= .000), and MHI 2000 (t= 4.265, p= .024). Percent Bachelor's degree achieved significance at the .10 level (t= 2.619, p= .079). MHI in 2009 also achieved significance at that level (t= 2.441, p = .092).

Corridors in the westernmost segment (Origin), the one with the largest proportion of Hispanic or Latino residents, revealed no significant differences between the differentially sized corridors. However, differences in Percent with Bachelor's degrees, MHI2009, and change in MHI achieved significance at the .10 level.

### *Cluster Analysis*

Many of the TOD studies cited and reviewed for this paper made use of cluster analysis to identify the types of community segments that would be served by the transit system being planned (Atkinson-Palombo and Kuby, 2011; Malekafzali and Bergstrom, 2011). I used a simple K-Means clustering approach to identify the socioeconomic features of the areas around stations that would most clearly identify their character. Of course, in this kind of analysis, the goal is the identification of segments, or clusters that are most different from each other, and to use those differences as a basis for naming, characterization or "branding."

This first analysis used the ½ mile radius and six socioeconomic variables transformed into Z-scores to identify five clusters. An analysis of variance indicated that the largest contribution, in terms of explaining the variation across the clusters, was Population size (F= 49.219). The next in terms of variation across clusters was the Percent Hispanic (F= 45.193). The least variation across clusters was associated with change in Median Household Income (F= 11.245).

The population within the Cluster3 differs most from the populations in Clusters 2 and 1, while the population in Cluster4 differs most from those in Clusters3 and 1. The differences between these clusters can be used as a basis for exploring comparisons of the "character areas" identified by the planners in terms of the differences in the clusters to which they have been assigned.

Cluster3 differs most from the other clusters in this set. The stations in this cluster are primarily from the westernmost area, identified as the city's "Origin," and the area with the highest proportion of Latino residents.

**Distances between Final Cluster Centers ½ mile radius**

| Cluster | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | 4.984 | **5.318** | **5.440** | 3.517 |
| 2 | 4.984 | | **6.568** | 4.133 | 2.586 |
| 3 | 5.318 | 6.568 | | **4.605** | 4.727 |
| 4 | 5.440 | 4.133 | 4.605 | | 3.409 |
| 5 | 3.517 | 2.586 | 4.727 | 3.409 | |

In the analysis based on the ¼ mile corridors, the analysis of variance identifies Percent Hispanic as accounting for the greatest differences between the clusters (F= 64.569), with Jobs per acre a close second in importance (F= 63.243). The least

important variable was the Housing and Transportation as a percent of income (F= 7.891).

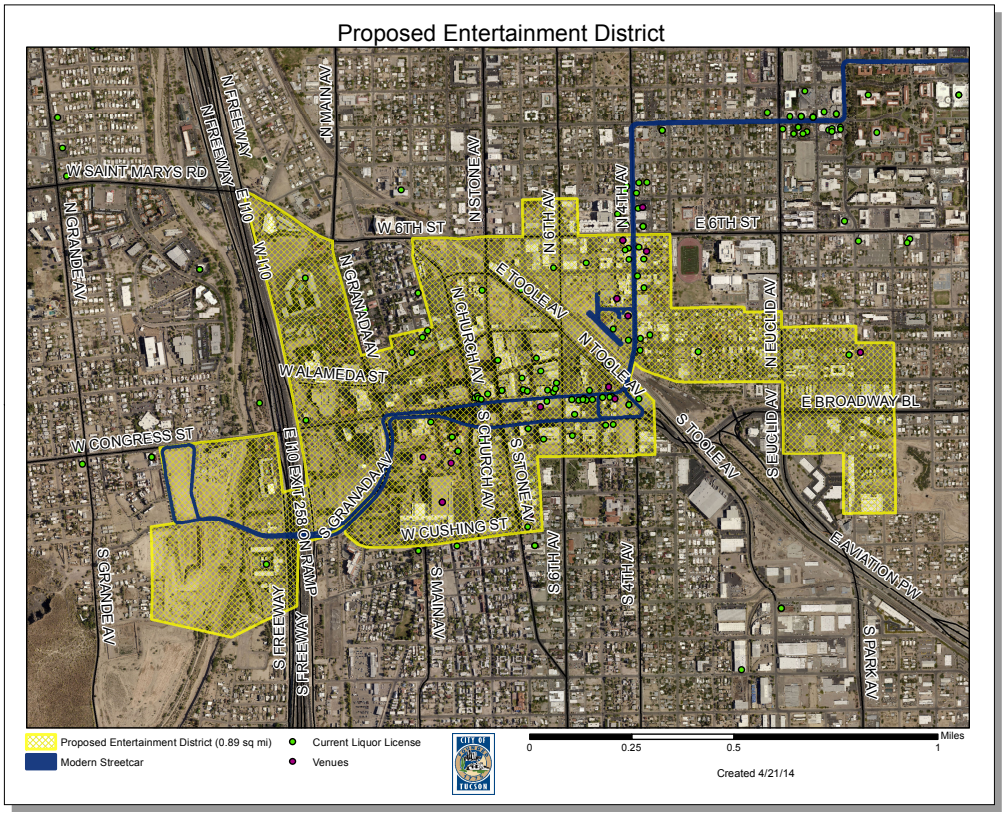
**Distances between Final Cluster Centers ¼ mile radius**

| Cluster | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | 3.560 | 2.468 | **5.202** | 2.871 |
| 2 | 3.560 | | **5.166** | **6.168** | 2.994 |
| 3 | 2.468 | 5.166 | | **5.651** | 4.353 |
| 4 | 5.202 | 6.168 | 5.651 | | 4.374 |
| 5 | 2.871 | 2.994 | 4.353 | 4.374 | |

In this case, the population in Cluster4 is the most "distant" from the populations in Clusters 2 and 3. While this cluster contains three of the same heavily Hispanic neighborhoods identified within Cluster3 of the ½ mile corridor, an additional neighborhood is included that just happens to have the 4th highest proportion of Hispanics within the corridor as a whole.

The fact that proportion Hispanic emerges as a primary basis for distinguishing between clusters, or neighborhood types is important to keep in mind as the impact of different planning strategies is assessed. The fact that the primary driver of the planning effort appears to be economic development related to tourism and entertainment invites concern about the impact of these changes in the current population.

In May 2014, the Tucson City Council approved the designation of an "Entertainment District" that encompasses almost the entire length of the streetcar route. This map suggests that nearly everything but the University of Arizona is now included within this newly designated place. This new special district makes it possible to serve alcoholic beverages within 300 feet of schools and churches; something that was previously barred by law. They also indicated that during the extended weekend period (Thursday-Sunday), the streetcar would continue to operate until 2 o'clock in the morning. Discussions have already begun to explore exempting businesses within this expanded entertainment district from the existing noise ordinance.




## Streetcar Planning Summary

These comparisons at the system, segment and cluster level of analysis have revealed several important differences between the impressions of the neighborhoods that would be derived from relying on larger or smaller corridors around stations as the basis for planning. Among the important differences observed in the comparisons within particular segments or character areas, we have identified several measures related to quality of life that are almost certain to change as the Streetcar moves from idea to reality.

Beyond the presence of Hispanics within neighborhoods, it may be that the most important indicator to explore is housing and transportation costs as a percent of income. While transportation costs could be expected to decline, housing costs will almost certainly rise in areas served by the streetcar. It is most unlikely that the shifts in median household income that we have seen are the result of long term residents earning higher salaries in the context of the Great Recession between 2000 and 2009. It is far more likely that those shifts reflect the substantial changes in population that have taken place in those neighborhoods.

Those patterns are consistent with what we would expect to see as a result of gentrification, and it is therefore not surprising that the greatest changes were observed in the westernmost and other traditionally Hispanic segments of the streetcar corridor.

These comparisons suggest that reliance on indicators derived from the narrower transit corridor have the potential to misinform planners about several of the socially relevant changes that are likely to affect the current and future residents of the neighborhoods surrounding the streetcar.

While the planning documents made available to the public offer no rationale for the somewhat unusual choice of the narrower corridor, we assume that the choice reflects the fact that the focus of the effort was on business development, rather than concerns about gentrification and social justice; something that the development community had already cast aside in some of their comments on Plan Tucson (Tucson, 2013a: 19).

## Conclusions

We set out to explore reasons for fearing that continued expansion in the use of GIS technology in support of local and regional development planning is likely to contribute to both the reproduction and the exacerbation of economic, social and political inequality, at least as it exists in the American Southwest. We chose to focus our attention on the urban neighborhoods in which substantial numbers of the residents would be characterized as comparatively poor. After establishing a basis for understanding how making a life within an environment marked by diminished opportunity and other hazards common to places defined by the widespread absence of resources, we explored some of the ways that cumulative disadvantage comes to be so concentrated in such a small number of places within our cities.

Although we noted that disparities are not only produced through denial and loss for the many, but also through delivering opportunity and advantage to the few, we emphasized the difficulties faced by those on the bottom, and by those who would advocate on their behalf to find relief within the courts, or through the local public sphere. Of course, our primary focus was on the contributions to this process being made through the analysis and visualization of geospatially identified TGI, and the potential that these systems had to accelerate, rather than limit the geofencing of particular neighborhoods as being too risky, or too socially distant to visit and explore.

Although the role of consumer-oriented, placed-based marketing was duly noted, we narrowed our attention further to the use of this technology in support of public participation in development planning, and then narrowed it further to explore its use in support of transit-oriented development (TOD). Examples of rather limited

participatory involvement in TOD projects around the U.S. were reviewed, taking note of the tendency of planners to focus on the "branding" of particular segments of transit corridors, while noting the role that race, ethnicity and class played in generating divergent socioeconomic paths to the future.

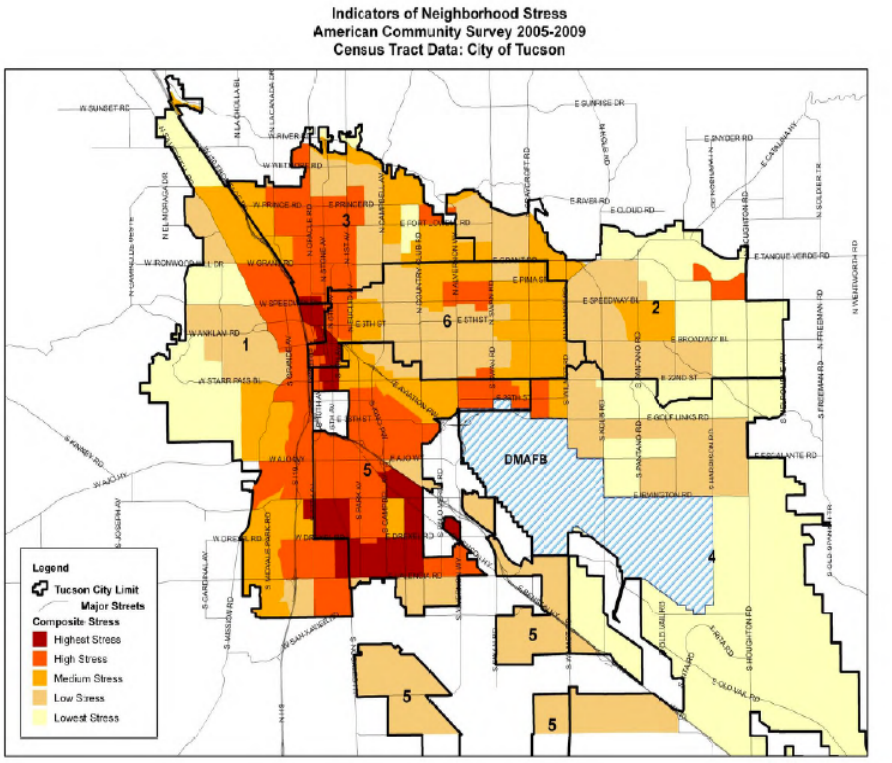
A series of recent planning exercises in Tucson did little to change our expectations that planning and redevelopment efforts in this rapidly growing city would once again lead to the displacement and victimization of members of the poor, ethnic minority communities.

We want to be clear, however, that the subordination of concerns about equity in Tucson's recent planning exercises should not stand as a proof that city managers are unconcerned about inequality and the well-being of its poor. Nor should it suggest that city planners are unaware of the levels of disparity within and between its neighborhoods.

Following an interval explained in part by the financial hardships occasioned by the Great Recession, the city published its second "Poverty and Urban Stress Report" in 2012. Using data at the census tract level gathered by the American Community Survey the city combined 26 measures into an index that allowed the levels of "stress" within particular neighborhoods to be assessed in relation to the averages for the city.

Along these same lines, we have noted that planners, committed neighborhood activists and university-based researchers have made good use of geo-referenced data to argue for or against specific redevelopment initiatives. Their ability to make use of GIS and public, private, and consumer-generated information about the character and quality of life within and between neighborhoods clearly means that it is not only possible, but also necessary for us to engage in surveillance of the environment.

There is a nearly self-evident need for critical scholars to identify, develop and assess new ways of revealing the underlying mechanics of the processes through which discrimination, injustice and the reproduction of inequality takes place. While for some, this may mean diving into the rapidly changing field of big data analytics, for a great many others it may involve the gathering and generation of information at the grass-roots level where others have feared to tread.




Source: City of Tucson, Poverty and Urban Stress, 2012

Just as information about socioeconomic group membership and identity is necessary to gather information and evidence about the nature of disparate impact discrimination, other sorts of information will be needed in order to anticipate which kinds of gentrification are more likely to emerge in which neighborhoods in response to particular the kinds of placemaking initiatives (Chapple, Chatman and Waddell, 2013).

We should recognize this kind of community oriented research as an application of a "precautionary principle"; one that seeks to establish the potential for harm well in advance of implementing a decision that would make that harm more likely (Allhoff, 2009; Rouvroy, 2008). In the same way that "environmental impact assessments" would lead to requirements for investors or developers to demonstrate that they have already identified strategies they will follow to limit, mitigate, or compensate those who are likely to be burdened by particular harms (Gandy, 2011), disparate impact assessments should also be required before smart growth initiatives are approved.

Although I have argued in the past about the need to limit the development and use of discriminatory technologies, I have come to believe that rather than attempting to stem the tide of progress in the development of GIS and other analytical resources, which would be akin to trying to hold back a rising tide in the wake of global warming, we need to do something else. I now believe that we should actually invite and support the use of sophisticated, multi-colored and animated 3-D simulations of development alternatives at user-determined levels of granularity or detail in order to assist decision-makers at all levels in deciding which options they ought to support or oppose (Crooks and Castle, 2012; Wu, He and Gong, 2009). However, I also believe that we should be particularly supportive of applications of technology that show the greatest promise for identifying policy choices and strategies that result in the contraction, rather than the expansion of inequality (Gandy, 2011: 184-185).

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