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Abstract
This paper investigates the social dimensions of gated communities in US western metropolitan areas and how they contribute to increased segregation. We use geographically referenced data to test the homogeneity of gated communities and their contribution to segregation. This paper introduces a local metric based on social distance indices (SDI), constructed by means of multivariate spatial analysis, that investigates homogeneity in three aspects: race and ethnicity, economic class and age between 2000 and 2010 census. The results indicate that gated communities significantly contribute to segregation patterns at a local level. Although socioeconomic segregation associated with racial and ethnic status yield the most prevalent structure of local distance, gated enclaves are significantly structured by age polarization. Nevertheless, gated communities contribute less to segregation in 2010 compared to 2000. They are also likely to be located within racially homogeneous areas, and therefore do not significantly contribute to racial segregation.

Keywords: segregation, inequality, US metropolitan areas, gated communities, spatial analysis.

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1. Introduction

From the early debates about gated communities until now scholars and observers have discussed the link between gating and segregation. Gated communities are residential developments (Common Interest Developments, CIDs) organizing the governance and social structure with an interlocking of spatial, legal, social system (Le Goix and Webster, 2008). Morphologically, gated communities are built as enclaves and have physical enclosures, secluding some collective urban space (parks, sidewalks, streets, common grounds, golf courses...) (Blakely and Snyder, 1997). Legally, property rights are implemented in property owners association (POAs), and private governance structure is designed to exclude others (i.e. selecting residents) (Kennedy, 1995; McKenzie, 1994; McKenzie, 2011; Owens, 1997). And socially, forms of securitization embed social strategies that facilitate the pursuit of "comfort" and social homogeneity (Low, 2003; Low, 2012).

In this paper we use geographically referenced data for metropolitan areas in the Western U.S. to investigate how gating as a residential process produces mostly homogeneous communities and leads to increased levels of segregation in urban areas.

We introduce a local metric based on social distance indices (SDIs), constructed by means of multivariate spatial analysis, that investigates homogeneity in three aspects: race and ethnicity, economic class and age between 2000 and 2010 census. This methodology brings a better understanding of the dynamic processes shaping suburbia, as it implements the concept of geographic discontinuity. By analyzing these discontinuities we are able to determine whether gated communities create significantly more homogeneous spaces compared to the surrounding neighborhoods. The research contributes to a well-established line of scholarly inquiries and helps to better understand the link between gating, segregation and urban inequality.

The paper is organized as follows: in Section 2 we discuss theoretical propositions and empirical findings related to the link between gated communities and residential segregation; Section 3 describes the methodology of the social distance index (SDI); Section 4 details the results, with a special focus on contributing factors (multivariate analysis), and on change between 2000 and 2010. The last section contains an overview of the most important findings and what they mean in the context of residential patterns in the U.S.

2. Background: gated communities and segregation

Gated communities in US western metropolitan areas account for a substantial part of the newly built subdivisions over the last three decades, and there has been a need for empirical assessment of how they have contributed to a reshaping of suburban social dimensions by means of walls and gates. By the year 2000 more than 15% of the United States housing stock was in Common Interest Developments (CIDs) — and the number of units in these privately governed residential schemes rose from about 701,000 in 1970 to about 20 million in 2009 (McKenzie, 2003; McKenzie, 2005;

McKenzie, 2011). The *Community Association of America* estimated in 2002 that 47 million Americans were living in 231,000 community associations and that 50 percent of all new homes in major cities belonged to community associations (Sanchez and Lang, 2005). Only a proportion — varying between 12 and 30 percent in the region of Los Angeles (Le Goix, 2005) — of these private local government areas are gated.

Since Blakely and Snyder's seminal book (1997), there has been a noticeable consensus among the authors who describe the security logic as a nonnegotiable requirement in contemporary urbanism and architecture, and all agree that 'both the privatization of public space and the fortification of urban realm, in response to the fear of crime, has contributed significantly to the rise of the contemporary gated community phenomena' (Bagaeen and Uduku, 2010, p. 3) in different national contexts around the world. In this paper we limit our analyses to the U.S., where a strong link has been established between security and fear of others — sometimes distinguished from the desire for security of person and property (Low, 2003).

Gated communities, as a member of the wider family of private urban governance, derive in the United States from a long history of exclusive regulations being implemented both in planning and land-use documents, but more significantly in the legal structuring of residential associations by means of restrictive covenants (Fox-Gotham, 2000; Kirby *et al.*, 2006). In a Tieboutean world, residential preferences and economic rationality prevail, and gated communities are understood as an exit-option from the public realm and from the over-regulated and overcrowded cities, with their inefficiency in providing community services, discussed under the terminology of "club economy" (Webster, 2007; Webster, 2002).

Analyzing the residential patterns through the prism of the history of racism in the United States also leads to the expectation of finding considerable level of separation among neighborhoods based on race/ethnicity. The application of restrictive covenants to residential neighborhoods has been instrumental in selecting residents throughout the first half of the 20th century, especially on the basis of race (Fox-Gotham, 2000). Real-estate markets usually consider social and racial heterogeneity as detrimental to property values and land markets. Both developers and governments have backed such discrimination. After the Fair Housing Act of 1968 that prohibited discrimination in housing, restrictive covenants and POA membership have however relied on age limitation (for retirement communities, owners must be above 55 years of age) and on required membership (e.g. in co-operative housing or country-club), that membership being subject to the approval of the board of directors (Kennedy, 1995). Although no reference to race or color can be made during the membership application process, the issuance of membership is discretionary, based on the principle that any club may regulate its membership (McKenzie 1994, 76), as long as the criteria for selecting prospective buyers remain reasonable. So far, sociability and congeniality have been considered reasonable criteria by the U.S. courts (Brower, 1992).

In a New York gated communities and condominiums case study, Low (2012) argues that private governance structures (condominium and residential associations) designed to exclude others and organize social homogeneity are as important as securitization strategies in shaping the social project in gated communities and exclusive housing schemes. Discourses on community are a manner for "residents and developers [to] manipulate what is perceived as a positive value and employ it to exclude and identify others, often with negative and even racist consequences (…) these "purified communities" redefine community as an intensely private realm, and in doing so, reinforce the boundaries of social acceptability and group acceptance in narrow, and discriminatory ways." (Low, 2012, p 198).

In this study, we hypothesize that gating a CID reinforces the private governance effort to segregate the residents from the "others" and therefore contributes to a relative social homogenization of the neighborhood. For instance, using the 2000 census and a geo-referenced dataset on 219 gated communities in the Los Angeles area, Le Goix (2005) showed that gated communities produced increased local segregation, compared to nearby non-gated CIDs and neighborhoods, with respects to socio-economic, ethnic status (White vs. Hispanics) and age and life-cycle.

We further hypothesize that the process of gating and the exclusiveness contribute together to foster a border that separates two territorial systems: the system of the GC, and the urban space where it is actually located. This border translates into a measurable spatial and social distance, between gated communities and the surrounding areas.

Besides the implementation of CC&Rs, several other processes help reinforce the social homogeneity of gated communities, which distinguish them from non-gated CIDs. The first of these are the design guidelines that guarantee homogeneous property values, along with broader private governance efforts to deter urban decay and protect property values over time. Studying the private streets of Saint Louis, Newman (1972) assumed a causal link between the resilience of a neighborhood, and its social homogeneity, the social control allowed by dead-ends over the collective space, and the street closure that have reinforced the feeling of ownership over entire neighborhoods (Newman, 1972). Since, it has been empirically demonstrated that gating a private neighborhood generates a price premium, better guarantees the homogeneity of property values within the neighborhood, and better protects values in the long run, when compared with other non-gated CIDs that are located in the vicinity (Bible and Hsieh, 2001; Lacour-Little and Malpezzi, 2001; Le Goix and Vesselinov, 2012).

3. Methodology: a spatial analysis of social distance

We estimate the effect of gating over social segregation, relying on the following hypothesis:

- Gating a CID reinforces the private governance effort to segregate the residents from the "others" and therefore contributes to a relative social homogenization of the neighborhood (Hypothesis 1).
- Gating a neighborhood contributes to separate territorial systems by borders that translate into measurable spatial and social distances, between gated communities and the abutting neighborhoods (Hypothesis 2).
- GCs are likely to produce increased local segregation if the overall differentiations occurring between gated enclaves and their vicinities are higher than the differentiations usually observed in the urban area between two adjacent neighborhoods (Hypothesis 3).

For this purpose, we have identified the exact location of GCs in a set of an initial set of 31 metropolitan areas (MSAs and PMSAs), available through Thomas Guides®[1]. We then match the newly constructed data for GCs with Census data at block group level. Using data from the 2000 and 2010 US Censuses, we identify the characteristics of the population living within and outside of the gated areas. This paper presents, compares and discusses the results for the 11 metropolitan areas for which the analysis yielded significant results. In all other areas, the quality of the sample does not allow to draw significant conclusions.

Gated streets

We use a geographically referenced dataset covering metropolitan areas in the Western US. Our dataset is based upon a ratio of gated streets to block groups (BG), constructed with proprietary data[2]. Aerial photographs from the usual on-line providers (Google Earth, MapQuest) have been also used to visualize residential physical patterns and the presence of gates. Field survey data collection has also

1 Bakersfield, CA; Chico--Paradise, CA; Flagstaff, AZ; Fresno, CA; *Las Vegas, NV--AZ*; *Los Angeles--Long Beach, CA*; Merced, CA; Modesto, CA; *Oakland, CA*; *Orange County, CA*; *Phoenix--Mesa, AZ*; Redding, CA; Reno, NV; *Riverside--San Bernardino, CA*; Sacramento, CA; Salinas, CA; *San Diego, CA; San Francisco, CA; San Jose, CA*; San Luis Obispo--Atascadero--Paso Robles, CA; Santa Barbara--Santa Maria--Lompoc, CA; *Santa Cruz--Watsonville, CA*; Santa Rosa, CA; Stockton--Lodi, CA; Tucson, AZ; Vallejo--Fairfield--Napa, CA; *Ventura, CA*; Visalia--Tulare--Porterville, CA; Yolo, CA; Yuba City, CA; Yuma, AZ (MSAs and PMSA with significant results in *italics*). In Phoenix--Mesa, gated streets were not available for Pinal county, and this county has been excluded from the analysis.

2 These data come from Thomas Bros. Maps®. The company publishes interactive maps that identify private streets. Access to vector maps allows spatial queries of gated streets, in order to identify gated neighborhoods. The files also contain information related to military bases, airfields, airports, prisons, amusement parks and colleges, some of which may also contain private streets with restricted access.

contributed to identify GCs as opposed to non-residential gated areas, and to control for the overall quality of data.

Social distance index (SDI)

The analysis of social distance aims to compare census block groups with an overrepresentation of properties in GCs (above a threshold of 50%) and block groups with an overrepresentation of non-gated subdivisions. We implement a social distance index (SDI) based on a methodology previously developed for the analysis of gated communities and segregation patterns (Le Goix, 2005).

Segregation, concentration and dissimilarity indices are known to be sensitive to spatial autocorrelation (Apparicio, 2000; Nelson *et al.*, 2004). It is also well know that these indices fail to account for spatial patterns (Massey and Denton, 1988; Nelson *et al.*, 2004; White, 1983; Dawkins, 2004). The spatial analysis at the neighborhood level primarily measures the social distance between one gated census block groups and adjacent (gated or non-gated) census block groups.

The proposed local SDI circumscribes usual spatial auto-correlation bias, as it measures the level of social discontinuity between adjacent areas, using a contiguity matrix. It derives from a theoretical framework that gives spatial metrics a heuristic role in understanding the building of social interaction and social distance (Grasland, 2009, p. 22). Several dimensions of the spatial organization are therefore revealed: barrier effects vs. homogeneity, territorial relations, and the meaning of spatial partitions at different geographical levels. The index equals the difference between the two contiguous areas *i* and *j* on a continuous factor *f*. The factor *f* is extracted from the factor analysis, and describes the relative coordinates of each area on a factorial axis produced by the joint effect of all independent variables. A discontinuity means that there is a statistically significant level of dissimilarity between two contiguous block groups. It is mapped as a segment showing the level of discontinuity, and compared with GCs' boundary layout.

The local social distance index measures the level of social discontinuity between two adjacent block groups (Figure 1). We can then analyze the spatial distribution of the SDIs, compared with the distribution of gated communities. This translates into comparing the SDIs between gated areas and abutting block groups with SDIs computed between block groups located in non-gated areas.

To present the results, we distinguish three levels, describing the different topological distances we use:

• Where gated streets represent more than 50% of a gated BG

• The vicinity of a gated block group,

• The BG with some gated streets.

• The other BG within the metropolitan area.

We expect to estimate the effect of gating on social segregation, relying on the following assumption: if the overall differentiations occurring between gated enclaves and their vicinities are higher than the differentiations usually observed in the urban area between two adjacent neighborhoods, then there is a high probability that GCs indeed produce increased segregation.

A multivariate analysis of SDIs by block groups

Three main characteristics of socioeconomic differentiation are analyzed, using the following variables for each block group, extracted from US Census 2000 (SF1 and SF3) and US Census 2010 (SF1) and American Community Survey 2010 (5 years estimate).

- Socioeconomic status: median property value; owner-occupied housing units (% of housing units),

- Race and Ethnicity: White non-Hispanic persons; Black persons; Hispanics; Asians; Native American origins, Others (% of population 2000),

- Age: less than 5 years old; 5-17 y.o., 18-21 y.o.; 22-29 y.o.; 30-39 y.o.; 40-49 y.o.; 50-64 y.o.; more than 65 y.o. (% of population).

To produce the index for both 2000 and 2010, census data have been geographically standardized to compare 2000 and 2010 census geographies. In order to do so, 2010 data have been fit into 2000 census block-groups boundaries, using an area weighted mean standardization method[3]. The results are consistent with these of Clark, in which he compared 2000 and 2010 census data in Los Angeles relying on equivalent population method (Clark *et al.*, 2012). Datasets have also been standardized across metropolitan areas, to allow comparison. A PCA has been run on a table describing each block groups, in their 2000 boundaries, each block group being analyzed twice, one line describing 2000, and one line describing 2010 variables.

Four factors have been extracted accounting for 60,3% of the total variance. The SDIs are calculated on these four factors. They can be mapped as line-segments, and their distribution compared. Factor 1 shows distance on White *vs.* Hispanic status, correlated with wealth and age status. On average it discriminates block groups with

3 We use the method implanted in the *Hawthtools toolkit* for ArcGIS (Beyer, 2004). It computes for an area weighted mean of the values in the fields specified. The area of the summary polygon that falls within the zonal polygon is derived from the polygon geometry, and is consistent with the geometric projection of the shapefile. Street-weighted interpolation could be applied (Reibel and Bufalino, 2005), that reduces errors in estimation with commonly applied area-weighting technique. Nevertheless, while this technique works well for denser inner suburban areas, it still yields errors up to within 2 std. dev. and more in exurban and outer suburban areas that are of primary interest for us given the preferred settings of gated subdivisions (Le Goix, 2005): 'these are regions in which many zones split over the given time interval, reflecting rapid development in the foothill areas' (Reibel and Bufalino, 2005, p. 135). Other methods such as population weighted means could also have been used, but knowing that the size of census boundaries is adjusted to population, surface related-bias have been tested, and are not significant.

an overrepresentation of wealthier White populations, on average more than 40 y.o., and owner status *vs.* block groups with an overrepresentation Hispanic and younger populations. Factor 2 describes the spectrum of life cycle connected to ownership status. It discriminates an array of block groups with an overrepresentation of 22-39 y.o., with Asian and other race status, versus block groups more better described by pure ownership status. Factor 3 describes another dimension of the life cycle, which is age polarization. It describes block groups with older (65+) population *vs.* block groups with an overrepresentation of ownership, younger and family oriented neighborhoods (30-39 y.o. and 17 y.o. and less). Racial segregation alone is described by factor 4. On the one hand of the spectrum, block group with an overrepresentation of Asian and pacific islanders versus white non-Hispanic population, everything being equal in terms of economic status.

4. Findings

GCs have significant yet geographically contrasted effects on segregation. Whereas data show a general trend towards more diverse gated communities, the spatial analysis of social distance show that gated communities do contribute to segregation patterns, and this has been locally reinforcing. Nevertheless, gated communities contribute on average less to segregation in 2010 compared to 2000. They are also likely to be located within racially homogeneous areas, and therefore do not significantly contribute to racial segregation.

General trends

First, some insights on the major changes occurring in the studied metropolitan areas help to better contextualize the role of gated enclaves, which are mostly owner-occupied (74% in 2010), whereas non-gated block groups have a lower share of owners (58%). The comparison of basic census categories shows on the one hand all the BGs, and on the other hand all gated-BG. In general, 2010 census data show more homogeneous neighborhoods, especially on race (Black *vs.* White segregation) and ethnicity, Hispanics being among others more ubiquitous in the different neighborhoods). This is consistent with the general trends already discussed by commentators and scholars (Glaeser and Vigdor, 2012; Reibel and Regelson, 2011).

In our sample, on average, the percentage of Hispanics has increased (30 to 35%) and data show a relative homogenization of their spatial distribution. The share of Hispanics in GCs has also slightly increased (10 to 12%). Within the same timeframe, the percentage of non-Hispanic White has decreased (75% in 2000, 68% in 2010) and this change has also an impact on GCs profiles percent of Whites significantly decreases (50% in 2000; 43% in 2010).

Aging also contributes to change: the percentage of 30-39 years old has declined, and this category is also underrepresented in gated BG, with a negative trend. On the other side of the spectrum, the 50-64 years old are on average increasing (18% in

2000; 22% in 2010) and overrepresented in GCs, with a positive trend. Median property values have also globally increased and homogenized between 2000 and 2010 in both gated and non-gated block groups, but they introduce more relative dispersion - and therefore more spatial differentiation - in gated block groups.

The impact of gated block groups on segregation patterns

As on Figures 1 to 4, we map SDIs to visualize the level of social discontinuity produced in gated areas. The shape and width of segments drawn describe the intensity of the discontinuities, under the assumption that a continuously shaped discontinuity outlines an independent territorial system with a strong social homogeneity highly differentiated from the outside, whereas a partial or segmented line of discontinuity designates a socio-spatial subsystem included within a larger territorial system (i.e. a municipality). Where the shapes of discontinuities are simple and clearly circumscribe a block group, therefore abutting the walls, it clearly demonstrates that gated communities build a specific territorial system within their urban environment. Within a certain distance from gated communities, the shapes of the discontinuities are rather complex an intricate. They are evidences of major discontinuities within a certain distance from the walls, thus including some gated communities within a buffer zone of homogeneous social patterns.

With the SDIs we determine whether a gated block group is likely to be more homogeneous than another block group nearby; and by doing so indicate social distance between neighborhoods. In such cases, where the SDIs are significantly above the average of the whole metropolitan area, maps directly translates the strength of the social wall separating one BG and another[4].

The SDIs above the one standard deviation threshold in the vicinity of GCs are consistent with the hypothesis of increased segregation produced by gates and walls and sustained by the private urban governance effort (Table 1). Gated block groups (A) and their direct vicinity, as well as block groups with only some gated streets (B), show a higher proportion of SDIs above the threshold of 2 standard deviation, than non-gated block groups: this demonstrates the correlation between gated block group geography and higher SDIs (above 2 *std. dev.*), as on factor 1 (14.1% of gated segments; 3.8% in non-gated areas) and on factor 3 (22.8% of segments in gated block groups; 3,1% in non-gated areas).

Some factors are highly contributing to segregation produced by gated communities, with a significant accentuating trend between 2000 and 2010. To continue this analysis, we also calculate SDIs ratio, *i.e.* the ratio between SDIs at the gated block group levels, and SDIs for all non-gated BG (Table 2). Where above the threshold of 1, the ratio indicates that GCs contribute more to local segregation than what is observed in the rest of the metropolitan area between non-gated block groups. As in

4 SDIs are clustered and mapped according to mean and standard deviation thresholds.

Table 2, in almost every metropolitan areas in this study, the ratio of the SDI between gated BG *vs.* other BG is usually higher than 1, except in San Jose, and occasionally admit very high values on selected factors (especially factor 3, Life cycle and age polarization).

Table 1. SDI frequencies by factorial axis and by geography levels in 2010 (all metropolitan areas)

		Freq. SDI % *				Univ. parameters of SDI absolute values			Student	
Geography level	N	-	+	++	+++	*mean*	*std dev.*	*CV*	*T*	*PRT*
Factor 1. *White vs. hispanic & latino status, correlated with wealth and age status.*										
A Gated block groups	1,029	62.3	23.6	9.4	4.7	1537.7	1447.0	94.1	34.0881	0.0001
Vicinity	2,462	73.2	19.1	5.6	2.2	1191.6	1187.7	99.7	49.7793	0.0001
B Block groups with GC	8,668	72.0	21.2	5.0	1.8	1189.3	1128.7	94.9	98.0953	0.0001
C Other BG	37,223	79.8	16.4	3.1	0.7	962.0	946.9	98.4	195.9973	0.0001
Total	*49,382*	*77.7*	*17.5*	*3.7*	*1.1*	*1025.3*	*1013.9*	*98.9*	*224.7230*	*0.0001*
Factor 2. *Life cycle and ownership status*										
A Gated block groups	1,029	66.0	25.1	6.7	2.2	902.6	858.8	95.1	33.7144	0.0001
Vicinity	2,462	71.1	19.7	6.3	3.0	886.4	903.3	101.9	48.6905	0.0001
B Block groups with GC	8,668	73.4	20.0	4.8	1.9	807.1	789.0	97.8	95.2380	0.0001
C Other BG	37,223	79.5	15.6	3.6	1.3	679.7	709.4	104.4	184.8702	0.0001
Total	*49,382*	*77.7*	*16.7*	*4.0*	*1.5*	*717.1*	*741.1*	*103.4*	*215.0095*	*0.0001*
Factor 3. *Life cycle and age polarization*										
A Gated block groups	1,029	53.4	23.7	9.3	13.5	1724.4	1800.3	104.4	30.7256	0.0001
Vicinity	2,462	74.6	17.1	4.1	4.1	976.7	1136.9	116.4	42.6293	0.0001
B Block groups with GC	8,668	77.1	16.1	3.6	3.1	896.3	1060.9	118.4	78.6565	0.0001
C Other BG	37,223	87.0	9.8	1.7	1.4	635.0	788.4	124.2	155.3974	0.0001
Total	*49,382*	*84.0*	*11.6*	*2.4*	*2.1*	*720.6*	*912.8*	*126.7*	*175.4383*	*0.0001*
Factor 4. *Racial segregation*										
A Gated block groups	1,029	77.6	19.0	2.2	1.2	553.6	606.7	109.6	29.2704	0.0001
Vicinity	2,462	80.1	15.4	3.0	1.5	555.3	720.5	129.7	38.2445	0.0001
B Block groups with GC	8,668	81.0	15.4	2.6	1.0	526.0	622.2	118.3	78.7141	0.0001
C Other BG	37,223	84.6	12.3	2.2	0.9	464.6	531.7	114.4	168.6014	0.0001
Total	*49,382*	*83.6*	*13.1*	*2.3*	*1.0*	*481.8*	*561.7*	*116.6*	*190.6071*	*0.0001*

*SDI levels: (-) x<= | 1std | (+) | 1std | <x<= | 2std | (++) | 2std | <x<= | 3std | (+++) >| 3std |

Sources: US Census 2000 and 2010 ; Thomas Bros. 2008 (gated streets).

Data show that on factor 1 (Whites vs. Hispanics, associated with wealth and age status), gated block group are have SDIs on average 1.5 higher than between non-gated block groups. This is even stronger in Phoenix, in San Francisco and in Ventura County. In San Francisco, social distance correlated with gated enclaves on factor 1, are mostly found in Marin County, north of the Bay area (Figure 3). In Phoenix (Maricopa County), some gated communities on the west side, as well as on the southeast corner of the city are also delineated by significant SDIs on factor 1 (Figure 1).

On factor 2 (Life cycle coupled with homeownership), data show contrasted results. Whereas SDIs for gated block groups are on average 1.4 times higher than for non-gated block groups, this criterion is less significant in Las Vegas, Los Angeles, San Diego. Everything being equal, it has no special effect in Phoenix (Figure 1), Oakland and San Jose (Figure 3). Nevertheless, factor 2 discriminates gated block groups in Orange County (Figure 4) with a ratio of 1.5. It delineates areas where gated block groups are clustered in South Orange County, in Laguna Niguel, Newport Beach and Irvine. It has an even stronger effect in San Francisco (Figure 3) where factor 2 yields higher levels of SDI nearby GCs, although decreasing between 2000 and 2010 (from 2.6, down to 1.8). This is also true in Santa Cruz (Figure 2) and in Ventura County (SDIs are twice higher for gated block groups).

Factor 3 (life cycle and age polarization) introduces a preeminent effect in differentiating areas with gated block groups from other non-gated neighborhoods: San Diego, Riverside, Los Angeles, Orange, Oakland and Phoenix for instance are good examples. SDI for gated block groups are on average 2 to 3.6 times higher than SDI for non-gated block groups in the metropolitan area, with a reinforcing trend in almost all metropolitan areas. The contribution of retirement communities has been preeminent in this process, and is well exemplified in Phoenix and in Orange counties, which both host numerous gated retirement communities such as Leisure World and similar subdivisions.

Factor 4 describes the dimensions of racial segregation that have not been captured by factor 1. This yields very contrasted trends. For instance, San Francisco shows in this respect a peculiar profile. There, gated communities contribute to racial segregation, and the trend is significantly ascending: the ratio was 3.1 in 2000 between gated block groups and other block groups; it has reached a level of 4.1 in 2010. As on Figure 2, this derives from a higher level of local discontinuities near San Francisco - San Mateo County limits. This factor also discriminate gated areas in Phoenix.

Gated communities do have an impact on segregation patterns, and this locally reinforces. And SDIs ratios are often above the threshold of significance. Factors 1, 3 and 4 yield the most significant levels of local SDIs due to gated enclaves, and trends towards the accentuation of segregation patterns can be noticed in Los Angeles, Oakland, Orange, Phoenix, Riverside and San Diego on factor 3; and in San Francisco, Phoenix and Ventura on factor 4. In Las Vegas however, the spatial clustering of GCs in the area is such that they do not have significant impact over segregation, everything being equal: SDIs ratios are on average lower on all factors, and the trend is descending on factor 4 (racial segregation) and slightly ascending on age segregation.

Table 2. SDI ratios by date (2000 and 2010)

	Factor 1 *White vs. hispanic & latino status. correlated with wealth and age status.*				Factor 2 *Life cycle and ownership status*				Factor 3 *Life cycle and age polarization*				Factor 4 *Racial segregation*			
ratio of SDI between*	gated BG / other BG		in the vicinity of gated BG / other BG		gated BG / other BG		in the vicinity of gated BG / other BG		gated BG / other BG		in the vicinity of gated BG / other BG		gated BG / other BG		in the vicinity of gated BG / other BG	
MSA / PMSA	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**
Las Vegas, NV	1,3	1,3	1,0	0,9	1,3	1,4	1,1	1,2	1,5	1,6	1,3	1,3	1,1	0,8	1,0	0,8
Los Angeles--Long Beach, CA	1,2	1,4	1,1	**1,2**	1,3	1,4	**1,3**	**1,4**	**2,8**	**3,1**	**1,6**	**1,6**	1,4	1,5	**1,3**	**1,3**
Oakland, CA	1,4	1,3	1,1	1,2	1,2	1,1	1,1	1,2	**3,4**	**3,6**	1,1	1,0	0,9	0,8	0,9	0,8
Orange County, CA	1,3	1,2	1,1	1,2	1,5	1,5	**1,4**	**1,5**	**2,7**	**3,0**	**1,6**	**1,7**	1,3	1,2	**1,2**	1,2
Phoenix, AZ	1,6	1,6	**1,4**	**1,4**	1,0	1,0	1,0	1,1	**2,4**	**3,0**	**1,4**	**1,7**	1,4	1,5	**2,1**	**2,5**
Riverside--San Bernardino, CA	**2,3**	**2,4**	**1,5**	**1,5**	1,3	1,3	1,1	**1,2**	**2,3**	**2,8**	**1,4**	**1,8**	1,3	1,3	1,1	1,1
San Diego, CA	1,3	1,4	1,0	1,0	1,3	1,4	1,1	1,1	**3,0**	3,3	**1,7**	**1,9**	0,8	0,7	1,0	0,7
San Francisco, CA	1,4	1,7	**1,4**	1,1	**2,6**	**1,8**	**1,5**	**1,5**	1,5	1,5	**1,4**	**1,4**	**3,1**	**4,1**	**3,1**	**2,8**
San Jose, CA	0,9	1,0	1,0	0,9	1,3	1,0	1,0	0,9	0,7	0,9	0,9	1,0	1,0	1,3	1,0	1,2
Santa Cruz--Watsonville, CA	1,5	1,5	1,0	1,0	1,5	1,6	1,2	1,3	1,4	1,6	0,8	1,0	1,1	1,5	0,7	0,9
Ventura, CA	1,6	1,8	0,9	0,8	2,2	2,2	0,9	0,8	**7,3**	**7,7**	**1,5**	**1,3**	0,7	1,3	**1,8**	**2,1**

* *cf.*Fig 2.

Sources : US Census 2000 and 2010 ; Thomas Bros. 2008 (gated streets).

A relative decreasing intensity of dissimilarities

The absolute values of the SDIs as well as the ratio describe the level of dissimilarity that has been produced across gated block groups. Change on SDIs, between 2000 and 2010 yields another important result: the intensity of SDIs globally decreases between 2000 and 2010 in relative terms (Table 3: the figures show the percentage of change of the SDIs for gated BG).

For gated block groups alone, SDIs between 2000 and 2010 follow negative trends. This means that on average and in absolute values, gated communities less segregate in 2010 than in 2000. This trend is also true for BG in the vicinity of GCs and has also been verified for non-gated BGs (Table 3).

In details, SDIs on factor 1 follow a moderate negative trend in almost all MSAs except San Francisco, San Jose and Ventura where it has slightly increased. The trends for SDIs on factors 2 and 3 are generally negative, except in San Diego and San Jose.

Table 3 shows ample change in all metropolitan areas, with striking figures showing the collapse of racial segregation alone (factor 4) nearby gated communities, with values often below the threshold of -20%, as in Las Vegas, Oakland, Orange, Riverside San Bernardino, San Diego, San Francisco, Santa Cruz and Ventura. This is compensated by some modest decreasing trends on factor 2 or 3: life cycle, homeownership and age polarization remain a powerful explanatory factor of segregation in gated communities.

Local contextual effects and buffer zones

A last consideration will be to consider again the ratio of SDIs, calculated between block groups adjacent to gated block groups, and all non-gated block groups (Table 2). This is a way to observe segregation patterns at *a certain distance from the walls and* *gates*, or more precisely at a topological distance of one block group from gated communities. In this case, the results indicate a powerful buffer zone effect in the vicinity of gated block groups. This effect is major in Phoenix or Riverside on factor 1, as areas nearby GCs introduce local dissimilarities 1.4 times above the average level in the rest of the metropolitan area. This buffer zone effect is also specifically relevant on factor 3 and 4, to better explain the larger local context where gated communities are located in. For instance, no only GCs are highly segregated on the base of race (factor 4) compared to the other BG in San Francisco, but the block groups nearby, although non-gated, show also a segregation level 2.8 times (in 2010) higher than in other parts of the metropolitan area in this respect. There are also evidences of such contexts building up "racial" buffer zones nearby GCs in Phoenix (ratio is 2.5 in 2010), Ventura (2.1) and on a more moderate basis in L.A. (1.3). Factor 3 (age cycle) also shows reinforcing patterns of age segregation around GCs (buffer zone effect) in San Diego (1.9), Riverside (1.8) and Orange (1.7).

Table 3. SDI change by metropolitan areas and by geographies (2000-2010)

	Factor 1 *Whites vs. Hispanics. correlated with wealth and age status.*		Factor 2 *Life cycle and ownership status*		Factor 3 *Life cycle and age polarization*		Factor 4 *Racial segregation*	
Vicinity levels*	**Gated BG**	**Nearby GC**	**Gated BG**	**Nearby GC**	**Gated BG**	**Nearby GC**	**Gated BG**	**Nearby GC**
Las Vegas, NV	-10,5	-12,6	-4,4	-4,3	-6,2	-9,5	-42,8	-39,7
Los Angeles--Long Beach, CA	-4,4	-8,8	-7,5	-1,9	0,8	-7,0	-13,2	-19,3
Oakland, CA	-9,6	-7,5	-15,5	-5,3	-4,4	-11,9	-29,5	-30,2
Orange County, CA	-13,6	-10,8	-13,4	-8,3	-7,0	-11,0	-31,9	-27,8
Phoenix, AZ	-9,5	-9,5	-11,5	-4,0	-1,0	-0,9	-14,6	-6,1
Riverside--San Bernardino, CA	-3,9	-8,1	-7,2	-5,7	0,1	-0,9	-26,7	-26,5
San Diego, CA	-1,1	-9,8	**4,3**	**-5,9**	-4,0	-1,4	-32,0	-40,5
San Francisco, CA	**12,6**	**-28,5**	-36,3	-9,8	-3,4	-10,6	**5,8**	**-26,1**
San Jose, CA	**2,6**	**-18,1**	-30,7	-14,6	**5,1**	**1,6**	-5,3	-17,3
Santa Cruz--Watsonville, CA	-8,8	-14,7	-8,7	-9,8	-15,7	-10,0	-19,5	-26,4
Ventura, CA	**2,6**	**-11,4**	-8,4	-8,7	-2,9	-21,2	**19,8**	**-20,5**

* Nearby GC are SDI in the vicinity of gated block groups.
Sources : US Census 2000 and 2010 ; Thomas Bros. 2008 (gated streets).

5. Discussion and conclusion

The results of this study based on a spatial analysis of social distance observed around gated communities and their vicinities in southwestern metropolitan areas indicate that gated communities significantly contribute to segregation patterns at a local level. The spatial analysis of social distance shows the impact of gated communities on segregation is significant and has been locally reinforcing, especially in areas where socioeconomic (status exhibition) or age characteristics (retirements communities) are specific characteristics attached to gated communities. Although socioeconomic segregation associated with Whites vs. Hispanics yield the most prevalent structure of local social distance, the characteristics of the SDIs caused by gated enclaves are very significantly structured by age polarization, due to the number of retirement gated communities. The overall structuring of segregation patterns due to gated enclaves has been rather stable over the last decade, although, on average, gated communities contribute less to segregation in 2010 compared to 2000. For racial segregation alone (factor 4), the contribution of gated communities to segregation patterns have significantly declined, expect in San Francisco and Ventura.

The results support the first hypothesis, that gating a CID reinforces the private governance effort to segregate the residents from the "others" and contributes to a relative social homogenization of the neighborhood. This also supports the second hypothesis, as measurable and significant social distances match block group boundaries defined as gated: social distance matches spatial distance in the case of gated communities.

A second important finding is that the adjacency between block groups (topological distance matrix), that is the distance from gated block group and nearby neighborhoods, introduces a considerable effect on segregation patterns. Thus, we find support for our third hypothesis that the level of differentiation between gated enclaves and their vicinities is higher than the differentiation usually observed in the urban area between two adjacent neighborhoods. The findings that gated communities do lead to increased local levels of segregation in turn lead to several considerations.

First, this shows further support for the argument that classical segregation indices imperfectly handle spatial patterns and require to either alter concentration indices with the use of a distance matrix, such as a 'spatial Gini index of segregation' (Dawkins, 2004), or to use indices that better delineate the patterns of spatial autocorrelation so as to compare local segregation patterns and different geographical levels (Le Goix, 2005). In Atlanta, a highly decentralized, sprawled and spatially fragmented metropolitan area, Dawkins (2004) points out the dependence of overall segregation on local spatial patterns of spatial autocorrelation, and suggests that there is an interaction between segregation patterns based on distance from the CBD, and nearest-neighbor patterns. To this light, our study shows that spatial proximity between adjacent neighborhoods can be decomposed in several layers of segregation patterns. Gated community adjacency highly contributes to local segregation patterns on factor 3 (Life cycle and age polarization) and factor 1 (Whites vs. Hispanics correlated with wealth and age status).

Second, concluding that gated communities tend to accentuate local segregation patterns requires an analysis of the geographical levels that introduce the most segregation, and what are the factors prevailing for each geographical levels. A comparison of factor 4 (racial segregation, everything else being equal in terms of income, ownership status, age) illustrates an important issue that arises when comparing the different factors within one metropolitan area (Table 2): the relative importance of local patterns of racial segregation is less significant for gated block groups than between non-gated block groups. Local segregation patterns are therefore decomposed into several spatially interacting components. This is to be discussed in the light of other scholarly articles. In a study of New towns and segregation, Kato (2004) shows that racial dissimilarity indices are found to be usually lower in suburban areas than in CMSA, and much lower within New towns than in suburbs. Gordon (2004) found that planned developments in California were racially homogeneous but diverse in terms of class. The diversity of planned developments in terms of income is well articulated to our findings, showing that gated communities are more likely to segregate by income and status (owners vs. tenants). Gordon (2004) also finds that segregation within non-planned-development accounts for the greatest share of racial segregation, the reverse being a high level of racial homogeneity between planned developments.

These findings support the idea of CIDs and planned developments, a proportion of which being gated, are more likely to be homogeneous in terms of race. To discuss this, it should be noted that many gated communities are found nearby or within master planned projects developed on the suburban fringe or exurban areas, as this as been documented by empirical researches in Los Angeles (Le Goix, 2005, 2006) or in Las Vegas (McKenzie, 2005). It is common that gated communities are neighbors to other gated communities and non-gated CIDs, such as in the southern part of Orange county, Riverside or San Bernardino counties. It derives from this that comparing gated communities to other nearby communities with an index based on adjacency means in fact in many cases comparing GCs to other GCs, or GCs to non-gated CIDs.

As a consequence, we suggest that gated communities contribution to segregation patterns unfold through racially homogenous local areas within suburbs. This means that gated communities indeed create local segregation patterns (on factors 1 and 3, mostly); but are entrenched within larger areas of racial homogeneity. Gated communities locally accentuate segregation: within existing segregation patterns, they differentiate from adjacent neighborhoods according to age and socioeconomic status (income and ownership) associated with White vs. Hispanic status. But they do not clearly accentuate racial segregation *per se* everything being equal; neither do they contribute to increased social mix according to racial and ethnic status.

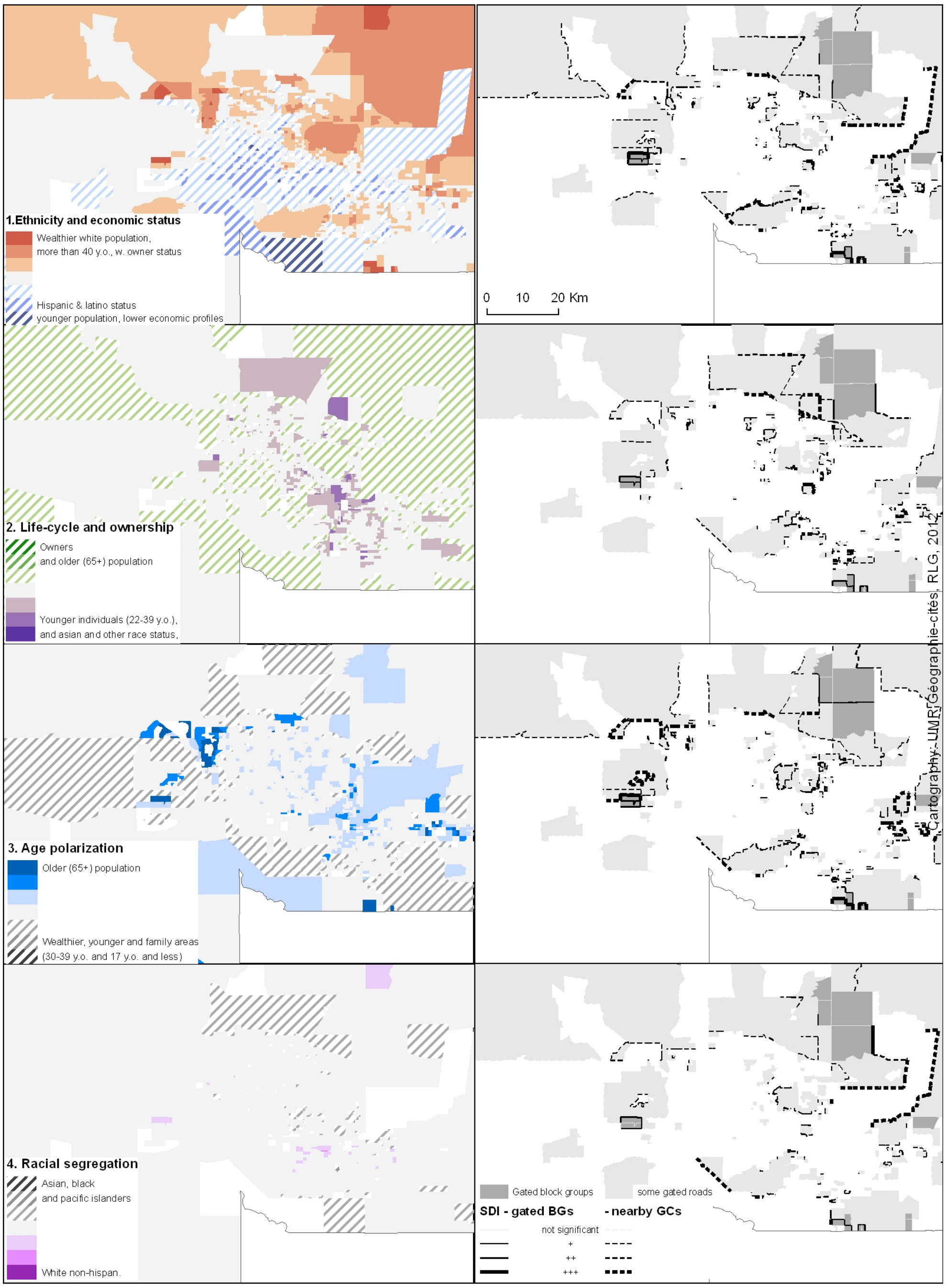

Figure 1. Map of factorial axis and SDIs in Phoenix (2010).

Sources: U.S. Bureau of Census. 2010; Thomas Bros. 2008 (gated streets).

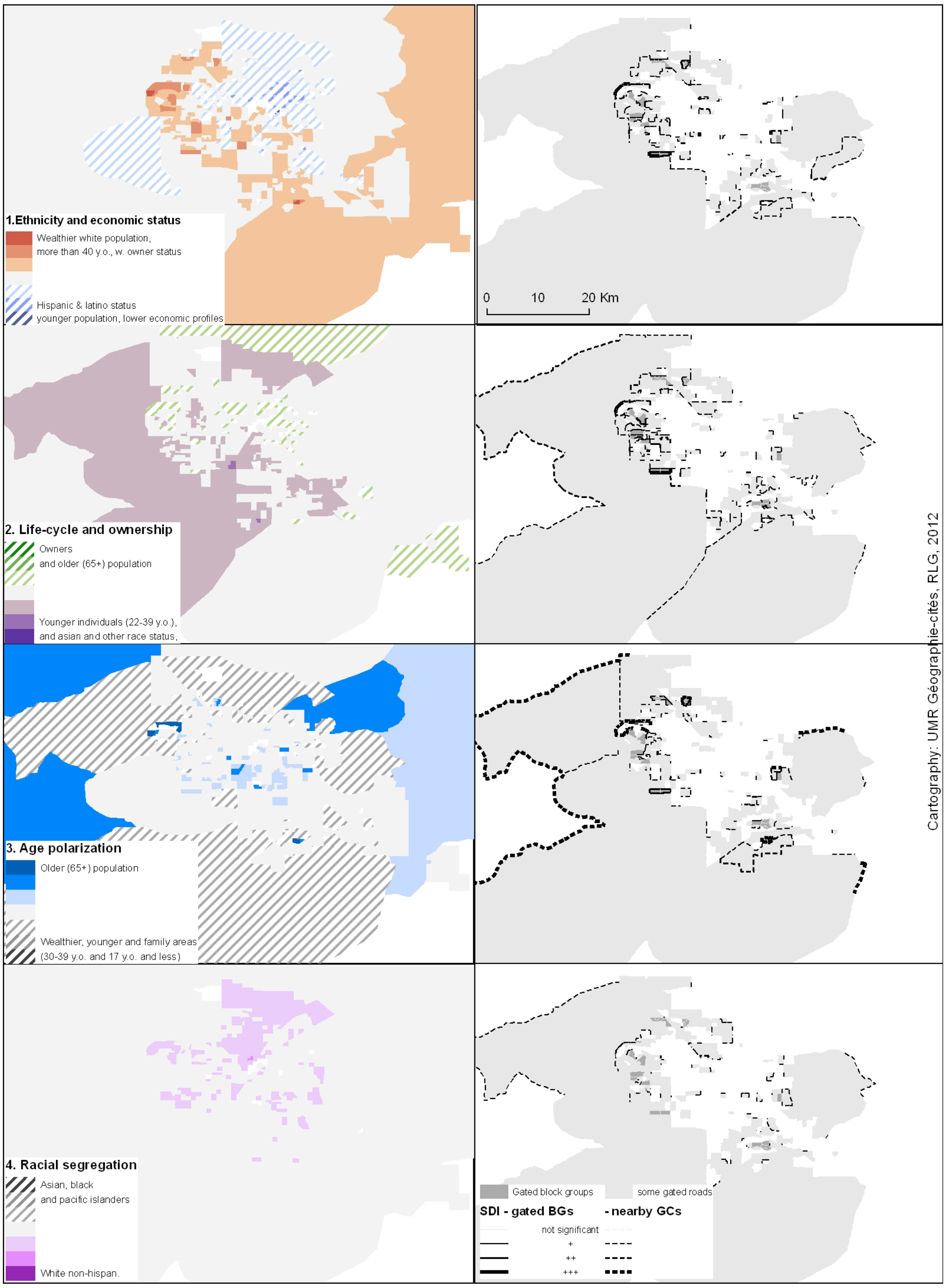

Figure 2. Map of factorial axis and SDIs in Las Vegas (2010).

Sources: U.S. Bureau of Census. 2010; Thomas Bros. 2008 (gated streets).

Le Goix, R. and Vesselinov, E. (2015) Inequality Shaping Processes and Gated Communities in US Western Metropolitan Areas, *Urban Studies*, **52**(4), pp. 619–638. DOI:10.1177/0042098014532555

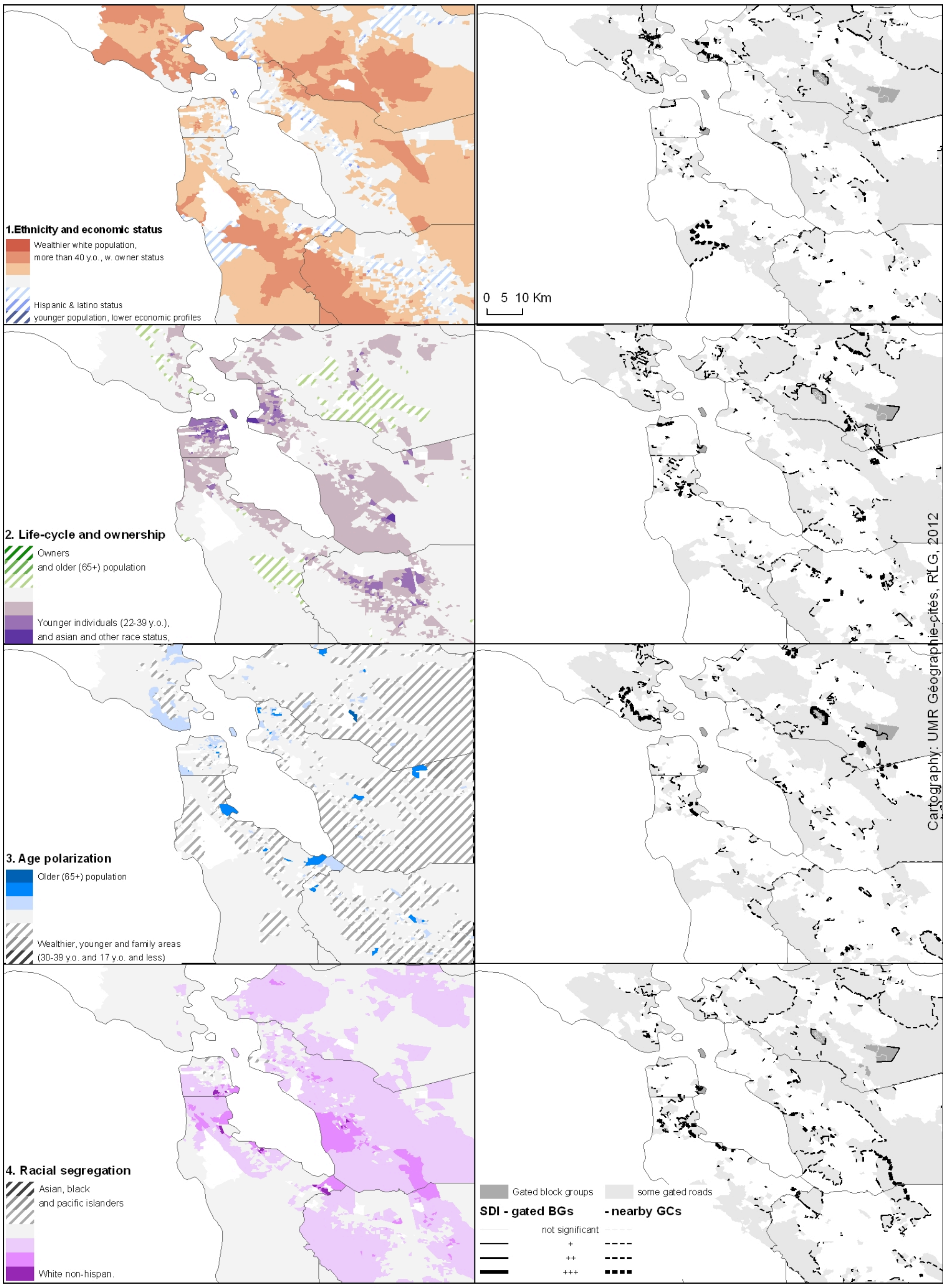

Figure 3. Map of factorial axis and SDIs in the San Francisco Bay area (2010).

Sources: U.S. Bureau of Census. 2010; Thomas Bros. 2008 (gated streets).

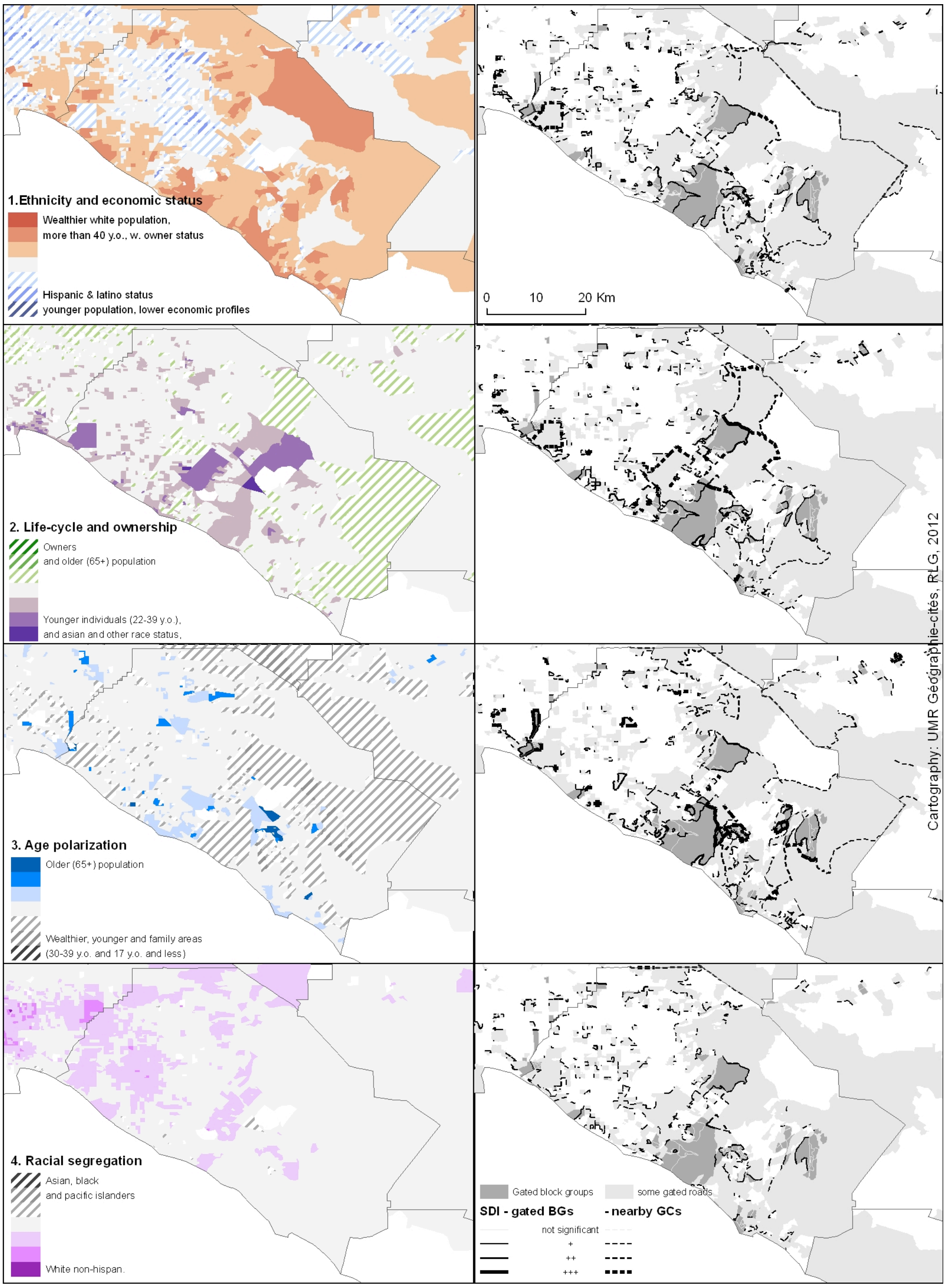

Figure 4. Map of factorial axis and SDIs in Orange county (2010).

Source: U.S. Bureau of Census. 2010; Thomas Bros. 2008 (gated streets)

Bibliography

Apparicio, P. (2000) Indices of residential segregation: an integrated tool in geographical information system., *Cybergeo*, 134, DOI : 10.4000/cybergeo.12063

Bagaeen, S. and Uduku, O. (Eds) (2010) *Gated communities: social sustainability in contemporary and historical gated developments*. London: Earthscan.

Beyer, H. L. (2004). *Hawth's Analysis Tools for ArcGIS*. (http://www.spatialecology.com/htools; accessed Mar. 2013).

Bible, D. S. and Hsieh, C. (2001) Gated Communities and Residential Property Values, *Appraisal Journal*, 69(2), pp. 140-145.

Blakely, E. J. and Snyder, M. G. (1997) *Fortress America, Gated Communities In The United States*. Washington D.C., Cambridge, M.A.: Brookings Institution Press & Lincoln Institute of Land Policy.

Brower, T. (1992) Communities within the community: consent, constitutionalism, and other failures of legal theory in residential associations., *Land Use and Environmental Law Journal*, 7(2), pp. 203-273.

Clark, W. A., Malmberg, B. and Osth, J. (2012) *Where Does the Mixed Race Population Live: Evidence from Los Angeles ?,* in: American Association of Geographers Annual Meeting - AAGs 2012. New York.

Dawkins, C. J. (2004) Measuring the Spatial Pattern of Residential Segregation, *Urban Studies*, 4(2004), pp. 833-851. DOI: 10.1080/0042098042000194133

Fox-Gotham, K. (2000) Urban Space, Restrictive Covenants and the Origins of Racial Segregation in a US city, 1900-50, *International Journal of Urban and Regional Research*, 24(3), pp. 616-633. DOI: 10.1111/1468-2427.00268

Glaeser, E. and Vigdor, J. (2012) *The End of the Segregated Century: Racial Separation in America's Neighborhoods, 1890-2010, in: Civic Report.* New York: Manhattan Institute for Policy Research, pp. 26 (http://www.manhattan-institute.org/html/cr_66.htm; accessed Jun. 2012).

Gordon, T. M. (2004) Moving Up by Moving Out? Planned Developments and Residential Segregation in California, *Urban Studies*, 41(2), pp. 441-461. DOI: 10.1080/0042098032000165334

Grasland, C. (2009) Spatial analysis of social facts. A tentative theoretical framework derived from tobler's first law of geography and blau's multilevel structural theory of society, in: F. Bavaud and C. Mager (Eds) *Handbook of Quantitative Geography*, pp. 46 p.: University of Lausanne.

Grasland, C., Mathian, H. and Vincent, J.-M. (2000) Multiscalar Analysis and map generalisation of discrete social phenomena: Statistical problems and political consequences, *Statistical Journal of the United Nations ECE*, (17), pp. 1-32.

Ihlanfeldt, K. R. (2004) Exclusionary Land-use Regulations within Suburban Communities: A Review of the Evidence and Policy Prescriptions, *Urban Studies*, 41(2), pp. 261-283. DOI: 10.1080/004209803200165244

Kato, Y. (2006) Planning and Social Diversity: Residential Segregation in American New Towns, *Urban Studies*, 43(12), pp. 2285-2299. DOI: 10.1080/00420980600950187

Kennedy, D. J. (1995) Residential Associations as State Actors : Regulating the Impact of Gated Communities on Nonmembers., *Yale Law Journal*, 105(3), pp. pp.761-793.

Kirby, A., Harlan, S. L., Larsen, L., Hackett, E. J., Bolin, B., Nelson, A., Rex, T. and Wolf, S. (2006) Examining the Significance of Housing Enclaves in the Metropolitan United States of America, *Housing, Theory & Society*, 23(1), pp. 19-33. DOI: 10.1016/j.polgeo.2007.06.010

Lacour-Little, M. and Malpezzi, S. (2001) *Gated Communities and Property Values,*Madison, WI: Wells Fargo Home Mortgage and Department of Real Estate and Urban Land Economics - University of Wisconsin, pp. 36 p.

Le Goix, R. (2005) Gated Communities: Sprawl and Social Segregation in Southern California, *Housing Studies*, 20(2), pp. 323 – 343. DOI: 10.1080/0267303042000331808

Le Goix, R. and Vesselinov, E. (2012) Gated Communities and House Prices: Suburban Change in Southern California, 1980–2008, *International Journal of Urban and Regional Research*. DOI: 10.1111/j.1468-2427.2012.01139.x (pre-print).

Le Goix, R. and Webster, C. J. (2008) Gated Communities, *Geography Compass*, 2(4), pp. 1189-1214. DOI: 10.1111/j.1749-8198.2008.00118.x

Lee, S. and Webster, C. (2006) Enclosure of the urban commons, *GeoJournal*, 66(1-2), pp. 27-42. DOI: 10.1007/s10708-006-9014-3

Low, S. (2003) *Behind the gates: life, security, and the pursuit of happiness in fortress America*. New York: Routledge.

Low, S. (2012) A multi-disciplinary framework for the study of private housing schemes: integrating anthropological, psychological and political levels of theory and analysis, *GeoJournal*, 77(2), pp. 185-201. DOI : 10.1007/s10708-009-9334-1

Massey, D. S. and Denton, N. A. (1988) The dimensions of residential segregation, *Social Forces*, 67(2), pp. 281-315.

McKenzie, E. (1994) *Privatopia: Homeowner Associations and the Rise of Residential Private Government*. New Haven (Conn.) ; London: Yale University Press.

McKenzie, E. (2003) Common interest housing in the communities of tomorrow, *Housing Policy Debates*, 14(1-2), pp. 203-234. DOI: 10.1080/10511482.2003.9521473

McKenzie, E. (2005) Constructing the Pomerium in Las Vegas: A Case Study of Emerging Trends in American Gated Communities, *Housing Studies*, 20(2), pp. 187-203. DOI: 10.1080/0267303042000331727

McKenzie, E. (2011) *Beyond Privatopia : Rethinking Residential Private Government*. Washington, DC, USA: Urban Institute Press.

Nelson, A. C., Dawkins, C. J. and Sanchez, T. W. (2004) Urban Containment and Residential Segregation: A Preliminary Investigation, *Urban Studies*, 41(2), pp. 423-439. DOI: 10.1080/0042098032000165325

Newman, O. (1972) *Defensible Space: Crime prevention through Urban Design*. New York: MacMillan.

Owens, J. B. (1997) Westec Story : Gated Communities and the Fourth Amendment, *American Criminal Law Review*, 34(3), pp. 1127-1160.

Purcell, M. (1997) Ruling Los Angeles : Neighborhood movements, Urban Regimes, and the Production of Space in Southern California, *Urban Geography*, 18(8), pp. 684-704. DOI: 10.2747/0272-3638.18.8.684

Reibel, M. and Regelson, M. (2011) Neighborhood Racial and Ethnic Change: The Time Dimension in Segregation, *Urban Geography*, 32(3), pp. 360-382. DOI: 10.2747/0272-3638.32.3.360

Reibel, M. and Bufalino, M. E. (2005) Street-weighted interpolation techniques for demographic count estimation in incompatible zone systems, *Environment and Planning A*, 37(1), pp. 127-139 (http://www.envplan.com/abstract.cgi?id=a36202.

Sanchez, T. and Lang, R. E. (2005) Security vs. Status ? A First Lool at the Census' Gated Community Data, *Journal of Planning Education and Research*, 24(3), pp. 281-291. DOI: 10.1177/0739456X04270127

Vesselinov, E., Cazessus, M. and Falk, W. (2007) Gated communities and spatial inequality, *Journal of Urban Affairs*, 29(2), pp. 109-127. DOI:10.1111/j.1467-9906.2007.00330.x

Vesselinov, E. and Le Goix, R. (2009) From Picket Fences to Iron Gates: Suburbanization and Gated Communities in Phoenix, Las Vegas and Seattle, *GeoJournal*, 77(2), pp. 203-222. DOI : 10.1007/s10708-009-9325-2.

Webster, C. (2007) Property rights, public space and urban design, *Town Planning Review*, 78(1), pp. 81-101.

Webster, C. J. (2002) Property Rights and the Public Realm: Gates, Green Belts, and Gemeinschaft, *Environment and Planning B: Planning and Design*, 29(3), pp. 397-412. DOI: 10.1068/b2755r

White, M. J. (1983) The measurement of spatial segregation, *American Journal of Sociology*, 88(5), pp. 1008-1018.