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Inequality shaping processes and gated communities in US western metropolitan areas

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Abstract

This paper investigates the social dimensions of gated communities (GCs) in US western metropolitan areas and how they contribute to segregation. We use geographically referenced data of GCs, and introduce a local metric based on social distance indices (SDI). This multivariate spatial analysis investigates homogeneity in three aspects: race and ethnicity, economic class and age between 2000 and 2010 census. The results indicate contrasting effects given different levels of geography. GCs significantly contribute to segregation patterns at a local level, and this has been locally reinforcing. Although socioeconomic segregation and ethnic status yield the most prevalent structure of local distance, gated enclaves are also significantly structured by age. The findings are considered in the context of a metropolitan decline in levels of segregation. Data also show that GCs are likely to be located within large racially homogeneous areas, and do not significantly contribute to racial segregation.

Keywords

gated communities; inequality; segregation; spatial analysis; US metropolitan areas

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) organising 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, 2011; Owens, 1997). And socially, forms of securitisation embed social strategies that facilitate the pursuit of 'comfort' and social homogeneity (Low, 2003, 2012).

In this paper we use geographically referenced data for metropolitan areas in the western USA to investigate how gating as a residential process produces mostly homogeneous communities and leads to increased levels of segregation in metropolitan 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. This method determines whether gated communities create significantly more homogeneous spaces compared with the surrounding neighbourhoods. The research contributes to a well-established line of scholarly inquiries and helps to better understand the link between gating, segregation and urban inequality.

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. According to the Community Association of America, the number of units in these privately governed residential schemes rose from about 701,000 in 1970 to about 24 million in 2009, in 305,400 Common Interest Developments (McKenzie, 2011; Sanchez and Lang, 2005). Only a proportion – varying between 12% and 30% 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 non-negotiable 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: 3) in different national contexts around the world. In this paper we limit our analyses to the USA, 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). Sassen (2013) also considers gated communities (GCs) as another type of assemblage of bits of territory, authority and rights once ensconced in the larger geographical unit of the city: as emergent frontier-space function, GCs are associated to the hard-wired bordering inside cities:

The uses that global corporate capital makes of 'our' cities are part of that hard bordering. The common assertion that we are a far less bordered world than 30 years ago only holds if we consider the traditional borders of the interstate system, and then only for the cross border flow of capital, information and particular population groups.

(Sassen, 2013: 1).

Gated communities, as a member of the wider family of private urban governance, derive in the USA 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 Tieboutian 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, 2002, 2007).

Analysing the residential patterns through the prism of the history of racism in the USA also leads to the expectation of finding considerable level of separation among neighbourhoods based on race/ethnicity. The application of restrictive covenants to residential neighbourhoods 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 colour 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 US 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 organise social homogeneity are as important as securitisation 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: 198)

In this study, we hypothesise that gating a CID reinforces the private governance effort to segregate the residents from the 'others' and therefore contributes to a relative social homogenisation of the neighbourhood. For instance, using the 2000 census and a georeferenced data set on 219 gated communities in the Los Angeles area, Le Goix (2005) showed that gated communities produced increased local segregation, compared with nearby non-gated CIDs and neighbourhoods, with respect to socioeconomic, ethnic status (White versus Hispanics) and age and lifecycle.

We further hypothesise 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 GCs and the surrounding areas.

Besides the implementation of Covenants, Conditions and Restrictions (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 neighbourhood and its social homogeneity, the social control allowed by deadends over the collective space, and the street closures that have reinforced the feeling of ownership over entire neighbourhoods (Newman, 1972). Since, it has been empirically demonstrated that gating a private neighbourhood generates a price premium, better guarantees the homogeneity of property values within the neighbourhood, 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, 2013).

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 homogenisation of the neighbourhood (Hypothesis 1).
- Gating a neighbourhood contributes to separate territorial systems by borders that translate into measurable spatial and social distances, between GCs and the abutting neighbourhoods (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 neighbourhoods (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 data set covering metropolitan areas in the western USA. Our data set is based upon a ratio of gated streets to block groups (**BG**), constructed with proprietary data.² Aerial photographs from the usual online providers (Google Earth, MapQuest) have been also used to visualise residential physical patterns and the presence of

gates. Field survey data collection has also 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 over-representation of non-gated subdivisions. We implement a social distance index (SDI) based on a methodology previously developed for the analysis of GCs 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 known that these indices fail to account for spatial patterns (Dawkins, 2004; Massey and Denton, 1988; Nelson et al., 2004; White, 1983). The spatial analysis at the neighbourhood 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 autocorrelation 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: 22). Several dimensions of the spatial organisation are therefore revealed: barrier effects versus 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 SDI measures the level of social discontinuity between two adjacent block groups (Figure 1). We can then analyse 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 (as in Table 1):

- Gated block groups: BG where gated streets represent more than 50% of the street network. This is compared to A', the vicinity of a gated block group,
- The BG with some gated streets.
- All other non-gated 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 (A and A') are higher than the differentiations usually observed in the urban area between two adjacent neighbourhoods (C), 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 analysed, 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 years; 18–21 years; 22–29 years; 30–39 years; 40–49 years; 50–64 years; more than 65 years (% of population).

To produce the index for both 2000 and 2010, census data have been geographically standardised 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 standardisation 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). Data sets have also been standardised 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 analysed 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 versus Hispanic status, correlated with wealth and age status. On average it discriminates block groups with an over-representation of wealthier White populations, on average more than 40 years old, and owner status versus block groups with an over-representation Hispanic and younger populations. Factor 2 describes the spectrum of lifecycle connected to ownership status. It discriminates an array of block groups with an over-representation of 22–39 years old, with Asian and other race status, versus block groups more better described by pure ownership status. Factor 3 describes another dimension of the lifecycle, which is age polarisation. It describes block groups with older (65 +) population versus block groups with an over-representation of ownership, younger and family-oriented neighbourhoods (30–39 years old and 17 years old 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.

Findings

Gated communities have contrasting effects given different levels of geography. This section discusses the general trends, highlighting that GCs do contribute to local segregation

patterns measured by the local SDI. At the same time, this finding has to be considered in the context of a metropolitan decline in levels of segregation, produced by the spatial diffusion of Hispanics and Asian. Thus, different space–time dynamics are jointly analysed.

General trends

First, some insights on the major changes occurring in the studied metropolitan areas help to better contextualise 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%). In general, 2010 census data show more heterogeneous neighbourhoods, especially based on race (Black versus White segregation) and ethnicity, Hispanics being among others better represented in both central and suburban areas. Several commentators and scholars (Glaeser and Vigdor, 2012; Reibel and Regelson, 2011) have observed this relative decrease of segregation.

For instance, in our sample, on average, the percentage of Hispanics has increased (30% to 35%) and data show a relative homogenisation 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: the percentage 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 under-represented 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 over-represented in GCs, with a positive trend. Median property values have also globally increased and homogenised 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.

Gated block groups increase local social distance

As in Figures 1 to 4, we map SDIs to visualise the level of social discontinuity produced in gated areas. The shape and width of line segments describe the intensity of the discontinuities: bold lines delineate ‘bits of territories’ that are highly differentiated from their vicinity, because of their social homogeneity. In places where the shapes of discontinuities continuously circumscribe a gated block group, it is evidence that gated communities build a territory within their urban environment. There are also visual evidences that some major discontinuities can be observed between non-gated block groups: GCs are not the only territorial process at stake in producing unequal patterns in close vicinity.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 (A’), as well as block groups with only some gated streets (B), show a higher proportion of SDIs above the threshold of 2 standard deviations, than non-gated block groups (C): this demonstrates the correlation between gated block group geography and

higher SDIs (above 2 standard deviations), 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. We also calculate SDIs ratio, i.e. the ratio between SDIs at the gated block group levels (A), and SDIs for all non-gated BG (C), as in Table 2. When the ratio is greater than 1, it indicates that GCs contribute more to local segregation than what is observed in the rest of the metropolitan area between non-gated block groups.⁵ As in Table 2, in almost every metropolitan area in this study, the ratio of the SDI between gated block groups versus other block groups is usually greater than 1, except in San Jose, and occasionally assumes very high values on selected factors (especially factor 3, Lifecycle and age polarisation).

Data show that on factor 1 (Whites versus Hispanics, associated with wealth and age status), gated block group SDIs are on average at least 1.5 times higher than between non-gated block groups, especially in Phoenix, San Francisco and Ventura. In San Francisco, SDIs correlated with gated enclaves on factor 1 are mostly found in Marin County, north of the Bay area (Figure 3). In Phoenix, 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 (lifecycle coupled with homeownership), data show contrasting 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 for GCs compared with non-gated block groups, 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 (lifecycle and age polarisation) introduces a pre-eminent effect in differentiating areas with gated block groups from other non-gated neighbourhoods, especially in San Diego, Riverside, Los Angeles, Orange, Oakland and Phoenix. 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 gated retirement communities seems paramount in Phoenix and in Orange counties.

Factor 4 describes the dimensions of racial segregation that have not been captured by factor 1. San Francisco shows in this respect a peculiar profile: GCs contribute to racial segregation, with significant increasing trend: 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 in Figure 2, this derives from a higher level of local discontinuities near San Francisco–San Mateo County limits. This factor also discriminates gated areas from non-gated areas in Phoenix.

Gated communities do have an impact on local segregation patterns, as measured by the SDI. Factors 1, 3 and 4 yield the most significant levels of local SDIs between gated and non-gated areas. Trends accentuating 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 on levels of 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.

Gated communities located in less segregated places

The values of the ratio between geographies (Table 2) account for the levels of dissimilarity that are measured between neighbourhoods, and the comparisons between 2000 and 2010 show that the level of local segregation produced by GCs has increased: compared with SDIs between non-gated block groups, GCs seem to contribute to segregation more than in 2000. But a more complete understanding requires a comparison of SDI values between 2000 and 2010: Table 3 summarises the change in SDI around gated block groups (A), and SDIs measured for block groups nearby gated block groups (A') on the other hand. On average, between 2000 and 2010, the intensity of SDIs decreases between 2000 and 2010 in almost every metropolitan area (Table 3: percent of change of the SDIs for gated BG).

For gated block groups alone, the average SDIs between 2000 and 2010 follows negative trends: gated block groups are less different from their immediate vicinity in 2010 than in 2000. This is also true for block groups in the vicinity of GCs (Table 3) and has also been verified for non-gated BGs: the average level of segregation in all metropolitan areas has been decreasing, and this is also the case for GCs and their vicinities.

In detail, 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 in gated block groups. 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 the striking amplitude of the collapse of racial segregation alone (factor 4) in block groups nearby GC, with values often below the threshold of 220%, as in Las Vegas, Oakland, Orange, Riverside San Bernardino, San Diego, San Francisco, Santa Cruz and Ventura. This is compensated by modest negative trends on factor 2 or 3: lifecycle, homeownership and age polarisation remain a powerful explanatory factor of segregation in gated communities. These results are consistent with recent studies: after decades of increased segregation (Modarres, 2004), the spatial diffusion of Hispanics, Asian and other minorities (Mixed Race for instance) within suburban areas yields increased racial heterogeneity (Clark et al., 2012; Glaeser and Vigdor, 2012; Reibel and Regelson, 2011).

To reconcile this finding with the other results discussed in this paper, we can summarise a dual space–time process. On the one hand, the average level of SDI, and especially racial segregation, globally decreases, in GC and in other types of neighbourhoods as well (Table 3); but on the other hand gated BG produce more social distance with their immediate vicinity in 2010 than in 2000, *everything being equal with the SDI measured between gated and non-gated block groups* (Table 2).

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 factors 3 and 4, to better explain the larger local context where GCs are located. For instance, not only are GCs highly segregated on the base of race (factor 4) compared with 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 LA (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).

Discussion and conclusion

The results of this study based on a spatial analysis of social distance observed between 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 (retirement communities) are specific characteristics attached to gated communities. Although socioeconomic segregation associated with Whites versus Hispanics yields the most prevalent structure of local social distance, the characteristics of the SDIs caused by gated enclaves are very significantly structured by age polarisation, because of the number of retirement GCs. The overall structuring of segregation patterns resulting from gated enclaves has been rather stable over the last decade, although, on average, segregation patterns have decreased between 2000 and 2010 because of the diffusion of Hispanics and Asian in suburban areas. As a result, for racial segregation alone (factor 4), the contribution of GCs 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 homogenisation of the neighbourhood. 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 distance from gated block group and nearby neighbourhoods (topological distance matrix) 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 neighbourhoods. 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 (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 decentralised and fragmented metropolitan area, Dawkins (2004) points out the dependence of overall segregation on local spatial autocorrelation, and suggests that there is an interaction between segregation patterns based on distance from the CBD, and nearest-neighbour patterns. To this light, our study shows that adjacency between neighbourhoods can be decomposed in several layers of segregation patterns. This is an important finding that corresponds to the fact that indices of segregation cannot capture the changes taking place at local or micro level. Our study delineates some cases where segregation patterns persist or increase (in gated block groups), in a context where segregation is declining.

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 levels. The buffer effect on factor 4 (racial segregation, everything else being equal in terms of income, ownership status, age) illustrates this issue (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. In a study of New towns and segregation, Kato (2006) shows that racial dissimilarity indices are found to be usually lower in suburban areas than in Consolidated Metropolitan Statistical Areas (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 and income. This is consistent with our findings, showing that GCs are more likely to segregate by income and status (owners versus 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.

As a consequence, we suggest that GCs' contribution to segregation patterns unfold through racially homogenous local areas within suburbs. This means that GCs 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 block groups according to age and socioeconomic status (income and ownership) associated with White versus 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.

Notes

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 neighbourhoods. 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.

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: 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.

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

5. From now on, when referring to local segregation according to the SDI criterion, we refer exclusively to the relative measure of social distance produced on average between gated block groups and their vicinity, normalised by the average SDI measured between other BG. This is provided in Table 2 in the gated BG/ other BG columns.

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Figure 1.

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

Sources: US Bureau of Census, 2010; Thomas Bros., 2008 (gated streets).

Figure 2.

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

Sources: US Bureau of Census, 2010; Thomas Bros., 2008 (gated streets).

Figure 3.
 Map of factorial axis and SDIs in the San Francisco Bay area (2010).
 Sources: US Bureau of Census, 2010; Thomas Bros., 2008 (gated streets).

Figure 4.
 Map of factorial axis and SDIs in Orange county (2010).
 Source: US Bureau of Census, 2010; Thomas Bros., 2008 (gated streets).

Table 1.

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

Geography level	N	Freq. SDI % ^a				Univ. parameters of SDI absolute values				Student	PRT
		-	+	++	+++	Mean	Std dev.	CV	T		
Factor 1. <i>White vs. Hispanics correlated with wealth and age status.</i>											
A Gated block groups	1,029	62.3	23.6	9.4	4.7	1537.7	1447.0	94.1	34.0881	0.0001	
A' Vicinity of gated BG	2,462	73.2	19.1	5.6	2.2	1 191.6	1 187.7	99.7	49.7793	0.0001	
B Block groups with GC	8,668	72.0	21.2	5.0	1.8	1 189.3	1 128.7	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. <i>Lifecycle and ownership status</i>											
A Gated block groups	1,029	66.0	25.1	6.7	2.2	902.6	858.8	95.1	33.7144	0.0001	
A' Vicinity of gated BG	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. <i>Lifecycle and age polarisation</i>											
A Gated block groups	1,029	53.4	23.7	9.3	13.5	1724.4	1800.3	104.4	30.7256	0.0001	
A' Vicinity of gated BG	2,462	74.6	17.1	4.1	4.1	976.7	1 136.9	1 16.4	42.6293	0.0001	
B Block groups with GC	8,668	77.1	16.1	3.6	3.1	896.3	1060.9	1 18.4	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	1 1.6	2.4	2.1	720.6	912.8	126.7	175.4383	0.0001	
Factor 4. <i>Racial segregation</i>											
A Gated block groups	1,029	77.6	19.0	2.2	1.2	553.6	606.7	109.6	29.2704	0.0001	
A' Vicinity of gated BG	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	1 18.3	78.7141	0.0001	
C Other BG	37,223	84.6	12.3	2.2	0.9	464.6	531.7	1 14.4	168.6014	0.0001	
Total	49,382	83.6	13.1	2.3	1.0	481.8	561.7	1 16.6	190.6071	0.0001	

^a SDI levels: (2) x|= | 1std | (+) | 1std ||x|= | 2std | (++) | 2std ||x|= | 3std | (+++) | 3std |.

Table 2.

SDI ratios for years 2000 and 2010.

Ratio of SDI between:	Factor 1				Factor 2				Factor 3				Factor 4			
	<i>Whites vs. Hispanics, correlated with wealth and age status</i>				<i>Lifecycle and ownership status</i>				<i>Lifecycle and age polarisation</i>				<i>Racial segregation</i>			
	Gated BG/ other BG	2000	2010	In the vicinity of gated BG/ other BG	Gated BG/ other BG	2000	2010	In the vicinity of gated BG/ other BG	Gated BG/ other BG	2000	2010	In the vicinity of gated BG/ other BG	Gated BG/ other BG	2000	2010	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

Note: Values in bold highlight SDI values above the average value of each column.

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

Table 3.

SDI change by metropolitan areas and by geographies (2000–2010).

Vicinity levels ^a	Factor 1		Factor 2		Factor 3		Factor 4	
	<i>Whites vs. Hispanics, correlated with wealth and age status</i>		<i>Lifecycle and ownership status</i>		<i>Lifecycle and age polarisation</i>		<i>Racial segregation</i>	
	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	-1 1.9	-29.5	-30.2
Orange County, CA	-13.6	-10.8	-13.4	-8.3	-7.0	-1 1.0	-31.9	-27.8
Phoenix, AZ	-9.5	-9.5	-1 1.5	-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

Notes: Values in bold highlight metropolitan areas where SDI change for Gated BG is positive.

^aNearby GC are SDI in the vicinity of gated block groups.

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