

## Urban Morphological Developments of a Post-Apartheid City

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### Abstract

This paper provides an analysis of the historic development of Cape Town's spatial configuration utilizing Space Syntax methodology. It recognizes how the topology of its mountainous and coastal forms, in succession with its historic spatial planning legislation, has cumulated to create barriers for cohesive growth between communities across the region. The result of segregated development of the historic centre and Central business district (CBD) to accommodate increased pressures on population growth, is arguably being reiterated in present time to perpetuate segregation for certain marginalised communities. This paper begins with a comparison of the historic, morphological change in Cape Town's urban street network from the period of pre-apartheid 1940's Cape Town, through to a 1980 map of implemented apartheid policy and finally a post-apartheid 2016 map. These three maps provide evidence-based recognition into the disparity between land-use pattern, which has remained relatively stagnant through the rapid population expansion of the city, and its impact of causing restrictive economic coherency for the subcentres within the spatial structure. The reiteration of poverty in certain areas remain racially-bound, regardless of efforts to decouple spatial segregation with race and a theoretical standpoint is taken which suggests urban morphology has an intrinsic impact on the socio-spatial development of the region. This paper aims to uncover the urban morphological trends, which could be contributing to perpetuating spatial patterns naturally emerging from consistent population growth in order to inform policy-decisions for the municipality moving forward. The main argument suggests that undesirable socio-economic conditions may be arising due to geographical and spatial contingencies causing the urban development of Cape Town to be polycentric in nature and with weak localised centralities.

### 1. Introduction

Cape Town is an urban system entrenched in deep complexities from a variety of political, historical, social, economic and environmental factors. Through the use of Space Syntax methodology, this paper will systematically tackle some of the layers that add to this complexity, to better understand the persistence of societal outcomes particularly related to employment and race. Firstly, the historic transformation of the urban network will be assessed based on the notion of *centrality* within the urban system, which provides insight into the morphological dimension of the spatial structure (Hillier 1999; Hillier and Penn 2004). Secondly, choropleth maps defining racial groups and employment split across the various wards based on census data will be analysed to define the functional dimension of the spatial structure, addressing the significance of the interrelationship between sub-centres in the city that emerge across various localities (Burger and Meijers 2012). To conclude, the paper will look outward to evaluate potential risks, impacts and adaptive strategies of this spatial structure scenario in order to identify the local government may be interested to consider in their development planning framework moving forward.

A configurational approach towards understanding growth and development of structural patterns of Cape Town's urban morphology has its strengths in disassociating traditionally politicised planning metrics, to understand through evidence the transformation of urban form that has manifested as a result of historical political power. From this perspective, Space Syntax provides the analytical toolkit by which the street network layout, analysed through graph theory and network analysis, are associated to various social and behavioural outcomes (Turner 2007; Karimi 2012). Uncovering the process of production of space and patterns to which urban forms are reproduced to influence socio-economic outcomes

provides empirical validation defining the political role in shaping future urban form. Space Syntax theory proposes that spatial urban structure shapes movement pattern and movement pattern shapes urban structure, with this paradigm providing explanatory power for spatial descriptions of social phenomena (Hillier 1996).

## 2. Cape Town: The Context

Cape Town is an urban region located in the Southern-most tip of South Africa, which experienced most of its urban expansion during the period of enforced apartheid. Apartheid government ensured the formal segregation of races as appropriating their own rights. Two significant pieces of legislature impacting the course of spatial planning includes the Group Areas Act of 1955 (renamed the Community Development Act in 1966) which divided group areas for the exclusive ownership and occupation of designated racial groups. In this tradition Black African's were allocated land the farthest distance from the Central Business District (CBD) where the government used buffer strips of rivers, open land or mountainous topography to ensure physical spatial barriers between allocated racial groups. These divisions were to ensure that social contact between communities would be reduced to a minimum in order to eliminate competition for urban space in the historic core, ultimately privileging opportunities for the, then superior, white population (Christopher 1994:103).

To ensure the displacement of these inferior racial groups, The Natives Resettlement Act of 1954 provided mechanisms to remove Africans from inner freehold areas. These inner suburbs were demolished and urban growth of the Black African and coloured population was to be restricted to the allocated perimeters of the city. Outward displacement of these racial groups caused by this division, lead arguably to spatial urban patterns and economic impoverishment that has perpetuated through spatial form in the present day. Furthermore, the urban population tripled to 5.3 million people in 1951 representing 42% of the total population (Christopher 1994). This suggests that the majority of Cape Town's current population are subject to living in suburbs developed on the basis of spatial apartheid planning and divisionary legislation.

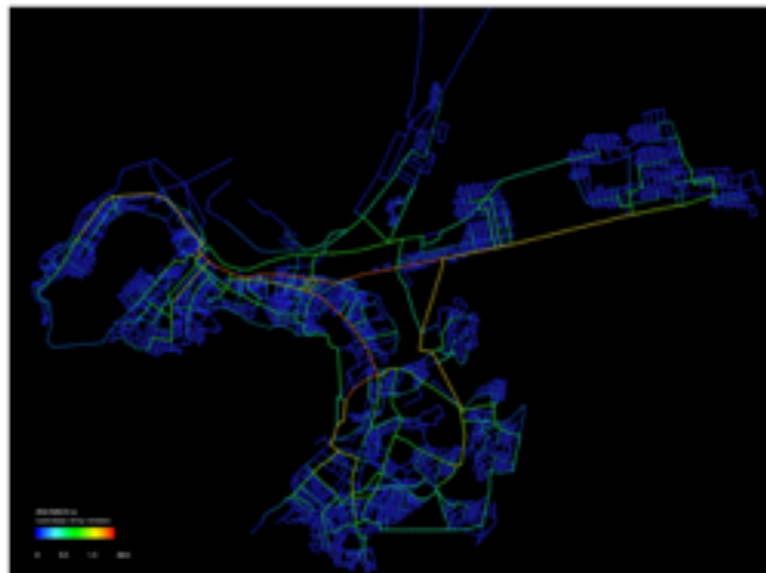
As current planning legislation functions with the attempt to "desegregate" the currently marginalized communities, who perpetuate socio-economic disempowerment in light of the apartheid regime, a critical evaluation on the current targets for change within the city council must be understood (City of Cape Town 2011; City of Cape Town 2017). There is a literature critiquing South African politics overall, which argues the 'neo-liberal turn' prioritizes the importance of gaining global traction and marketing as a competitive world city, above the needs of its poorest cities (Harrison 2003; Todes 2003). With an arena of deep social inequality, critical issues in Cape Town are vastly different across the spectrum of its citizens and their income groups, and arguably the recent restructuring of government and mayoral electoral board, has not yet adjusted to advocate the needed position of focusing on problems for their lower income citizens. This is evident where Harrison (2003) describes the observation by David Smith, that "despite improvement of service infrastructure in poor parts of the city, the apartheid legacy has been carried largely intact into the new era and that major structural reforms that were required to alter the trajectory of urban change did not occur [with the formalized end of apartheid legislation in 1994]" (ibid:2).

## 3. Historic Apartheid Transformations and Development of Urban Form

To understand whether new forms of fragmentation and segregation are indeed emerging in response to South Africa's changing position within the global economy, the case for a configurational, urban analysis has already been justified and will be developed in this paper. Firstly, this paper will present a normalized choice measure of the network segment analysis for the 1940 map of Cape Town (Fig. 2). The choice measure, counts the times a space is



*Figure 1: Segregated allocation of street network based on framework provided by the Group Areas Act based on 1979 planning legislation and demarcation on current urban street network.*



*Figure 2: Normalized Choice map of 1940 Cape Town at global scale radius  $n$ .*

passed, reflects the probability that a space is chosen as a mid-point for movement from one trip to one point in the system to another. This is also known as the through-movement potential. Figure 2 above shows choice measure at a global radius of  $R_n$  suggesting all topological steps are taken into consideration. The angular segment analysis drawn at this radius highlights the most significant routes within the network to be the routes demarcated in red. That is starting from the CBD and continuing in a north easterly direction and another parallel route moving to the south easterly direction. Interestingly, these two routes meet at an intersection which was the cosmopolitan community of District Six at the time. This was an area which was one of the most vibrant and ethnically mixed quarters of Cape Town pre-1940s and was demolished as part of the Natives Resettlement Act in 1964. These mixed communities were forcefully evicted to the townships allocated to them as part of the Group Areas Act (Fig.1) in the Cape Flats and other peripheral locations.

The demolition of District Six, located at the most narrow point of these two main arteries, would have caused extreme disruption in the flow of natural movement for people travelling from east to west (Hillier et al 1993). This spatial planning logic exemplifies a misalignment between spatial and functional logic that Space Syntax reveals, creating an inefficient use of urban space and lack of integrative planning measures. Coherency between the subcenters to arise as part of population growth would be vastly divisive from the existing CBD as a consequence of this inner-city demolition.

### **3.1 Outward Displacement of Marginalized Racial Groups**

Disparity in planning measures was exemplified as early as the District Six demolition, which following a drastic up rise in migrants moving into the city, the majority of populations were located at a distance from the CBD on basis of their ethnic classification. Before 1948 Cape Town was the most racially integrated city, yet post-apartheid was classified as the least ethnically integrated. By 1987 more than 1,300 group areas had been proclaimed, mapped on Figure 1, and forceful removals of 126,000 families, mainly Colored and Indian, with 1 million Black African being resettled within allocated urban areas from 1950 to 1990 (Fig.1). By proclaiming the inner cities and suburbs as white, other groups were pushed to the outskirts and resultingly experienced separate education, health, social services and even local authorities, leading to drastic living standards for these racially segregated areas (Christopher 1994). This would have large effects on the coherency of global urban form.

In terms of urban morphological form, social patterned use of space was not following the urban network as followed by normal functioning cities (Hillier and Hansen 1984). Instead movement of people and agglomeration of housing, infrastructure, centrality, land-use, were artificially-induced based on racial Group Areas Act. How this has created perpetuating cycles of decline for certain areas of the city is yet to be exposed. Figure 3 shows the normalized choice measure of an angular segment analysis of a 1980 map of Cape Town, by which apartheid policy was deeply entrenched in the further spatial growth of the city from the 1940 map (Fig. 2). What emerges in this map is a urban structure that does not follow the 'spiky potato' term coined by Hillier (1999) to describe the compact convexity in the live core of the city. Instead an extremely irregular shape is recognized in Figure 3.

The centre of the settlement usually has the highest concentration and mix of activities, creating 'live centrality' (Batty et al. 1997) where high levels of movement benefit land-use and diversity of mixing. The 'movement economy' theory (Hillier 1996) was developed following the notion of 'natural movement' (Hillier et al. 1993) to describe spatial organization that follows movement patterns influence land-use choices and then generate multiplier effects on movement to continue the more intensive development in the centre of the

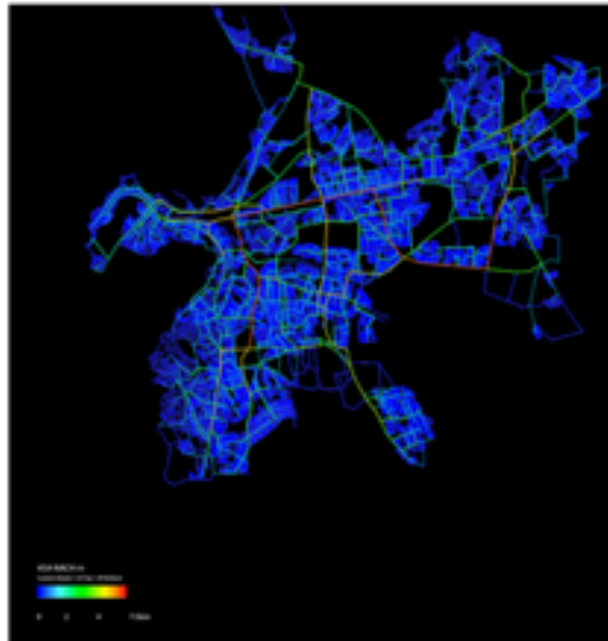


Figure 3: Normalized Choice map of 1980 Cape Town at global scale radius  $n$ .

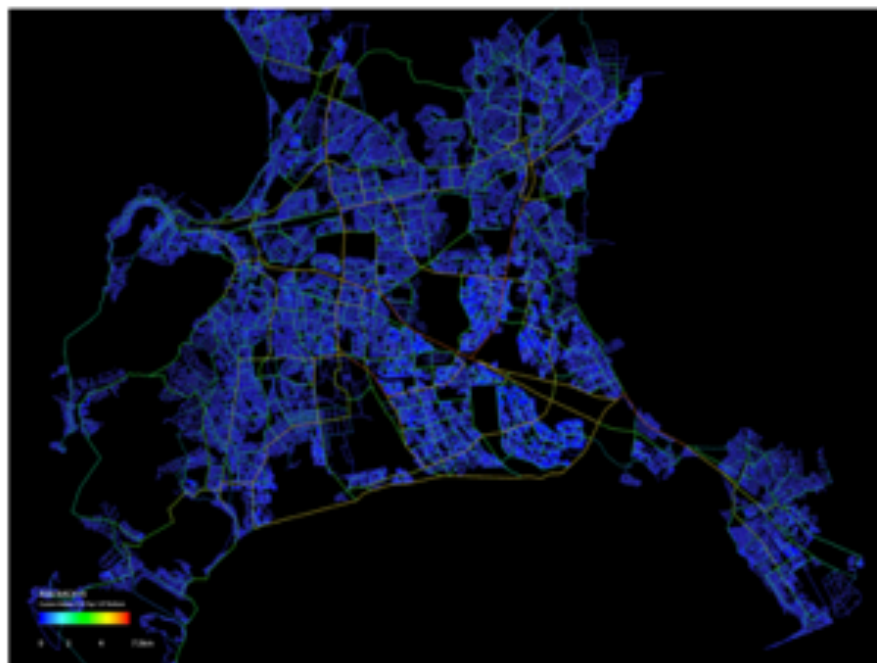


Figure 4: Normalized Choice map of 2016 Cape Town at global scale radius  $n$ .



settlement (Hillier 1999). Disfigured centrality as revealed in Figure 3 therefore suggests that the intensifying of the historic core is not occurring with use of the 'multiplier effect'. Thereby, the movement economy is not fulfilling its potential to create the diversity in the city-centre. The impacts this could have on social functioning, land-use patterning and economic dispersal throughout the city are potentially detrimental to the city.

### **3.2 Disfigured Centrality**

Hillier (1999) argues that it is the movement economy that characterizes cities as it provides the agglomerative potential of the virtual community by configuring the web of higher and lower intensity areas. Cape Town's urban network is not seamlessly integrated, but instead fractured based on the growth shown in the 1980 map (Fig. 3) and 2016 map (Fig. 4). Here the lack of a single centre suggests disparity between the network connecting all substructures within the city. Rather than providing a highly compact and land-use diverse global-centre, land-use adaption is not occurring as movement potentials provided by the urban network are restricted and fractured.

Centrality is understood across scalar levels ranging from global to local level centrality. Globally, the centre acts as the main attributive point for the region as a whole and single system. Locally, however communities within the local boundaries will be adhering to certain individual, local grid conditions. As settlements grow, spatial pressure inherently shifts the focus of centrality, allowing natural grid intensification and smaller block size to create greater ease of movement within the centre, also known as the 'Siksna process' (Hillier 199:108). Centrality happens as a natural relationship between configuration of urban forms and attraction of urban movement, however Cape Town has been historically planned to follow an artificially different centre, that of the historic CBD. The centre in this case has not been a natural attractor but artificially imposed to a different area based on rigorous continual treatment of most intensive central point for the white population and maintaining its land-use hierarchical structure. Rather than diversifying with growth, this imposed centre, marked as the historic centre in the 1940 map (Fig. 2), has maintained a homogenous reputation, therefore not diversifying or attributing different specialisms throughout the sub-areas of the city (ibid). Urban growth in a city of Cape Town's topography would naturally have a shifting centrality towards the centre of the system to where suburbs have developed, which has not occurred due to various enforced policies.

The centrality marked red on the 1980 map (Fig. 3) was once an 'edge city' and has continued to follow in this domain based on artificially enforced centrality remaining in the historic CBD. In this regard, suburbs have consequently become farther and more remote from the determined centre of Cape Town, causing administrative and employment opportunity problems. Not only is distance for marginalized communities to the enforced CBD a problem in terms of methods of commuting and accessibility, but the lack of follow-up of land-use to subcentres in Cape Town are unnaturally occurring. The main functional centre of Cape Town is restricted to the remote location of the historic CBD, which causes a number of problems in terms of preventing agglomerative potentials and multiplier effects associated with 'natural movement' and the 'movement economy' (ibid; Hillier 1996).

### **3.3 An Imposed Artificial Attractor of the Historic Centre and CBD**

The imposed artificial centre reduces the natural hierarchy of centres and subcentres that pervade a typical urban system to be reduced to *unrivalled* urban development. There are weak levels of competition and connectivity between subcentres contributing to the lack of production of a coherent centrality. To understand the impacts of an unused global centrality, normalized integration of segment angular analysis was analysed at both local scale radius of 5000m (Fig. 5) and global scale radius of  $n$  (Fig. 6). Integration measure maps the to-movement potential, suggesting the likelihood that certain places are a chosen destination.

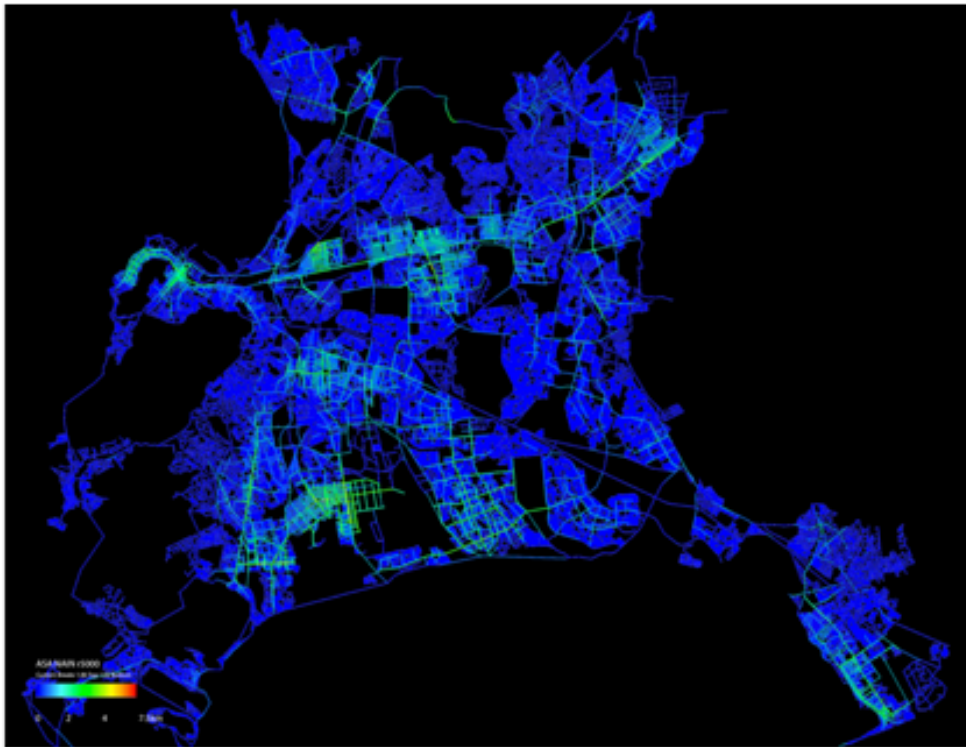


Figure 5: Normalized Integration map of 2016 Cape Town at local scale radius 5000 metres.

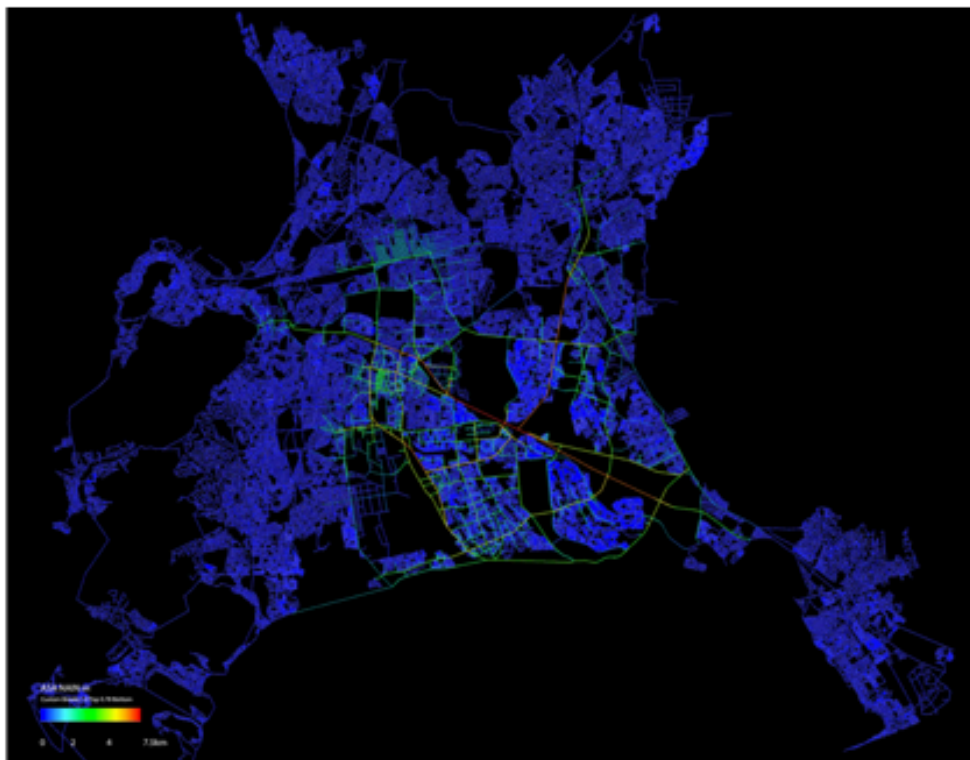


Figure 6: Normalized Integration map of 2016 Cape Town at global scale radius n.

There is a problem as the warm coloured structure that is revealed on both the local scale map (Fig.5) and global scale map (Fig.6) do not correspond with how the urban street network is actually used. Again, this suggests the divergence between natural movement pattern of the network due to artificial barriers to movement. Furthermore, these barriers are due to repeatedly reproduce to create continued fractured urban street network.

Divergence between hierarchy of centres and subcentres is revealed at local scale (Fig.5), where heated localities are separated further away from each other, without maintaining the global core as heated in Figure 6. This reveals the polycentric nature of the city, however suggests its failure to comply with actual movement economy patterns. At a global scale, the normal 'spiky potato' form does not exist (Fig. 3) and (Fig. 6) and at a local scale, global centrality does not appear and local centrality are moving towards opposite ends of the urban structure. This discontinuity reflects the result of a long-term effect of lacking rules of 'natural movement' and following the integrative process of the 'movement economy' (Hillier 1999).

Understanding the spatio-functional production of centrality is essential to identify linkages between policy and urban form, then providing the insight to conserve or change reproductive patterns based on what is spatially observed (Batty et al 1997:22). That configuration generates attraction does not hold if the socio-political system does not allow it to (Hillier 1999). Instead configuration is being bound to historic policy which is causing attraction inequalities within the urban centre and tactical spatial restructuring policies must be introduced to actively reintegrate communities. Allowing the spatial form to naturally follow its current spatial patterning will create further inequalities (Harrison 2003; Todes 2003).

The findings of this section have included an understanding of greater economic disparity than need be based on conservative spatial processes reiterating centrality as the artificial historic centre. Furthermore, centrality is not naturally shifting as response to the 'movement economy' that comes with population growth, leading to a great proportion of the population economically segregated. The spatial economy of the region follows the pattern of an 'edge city' for the large proportion of citizens, not integrating with the pre-existing urban form as seen in the shift in centrality from Figure 3 to Figure 6, therefore cutting off spread of economic prosperity. Communities with the highest income, are geographically located farthest from the artificially-imposed CBD and are able to add to the micro-economy, but all remaining subcentres of the settlement (Fig. 5) continue to be cut-off from this economic centre, perpetuating the cycle of racially-induced poverty who live disconnected. Buffer strips imposed by historic apartheid planning, remain in-tact between communities causing lack of appropriate cohesion and network connectivity for the entire urban region to function with its micro-economies. It is essential for post-apartheid planning take the network configuration of its spatial system into consideration. The responsibility remains for policy to reanimate the natural occurring centrality of the system and integrate opportunity for the currently cut-off masses, unlocking economic growth (Hillier and Vaughan 2007; Karimi 2012).

#### **4. Socio-economic Outcomes of Post-apartheid Planning**

The syntactic analysis and its limitations have been diagnosed in representing the urban structure of Cape Town, it is essential to evaluate the possible outcomes as fed through the census report of social coherency and employment opportunity for communities most effected by spatial structure. Ultimately, those least economically privileged are most effected by the centrality or lack of, within the urban structure. It is evident in Figures 7-9 that group population census is following the same permutations as was enforced by the Group Areas Act of 1955. That is, black populations restricted to very small allocated areas (Fig.8) and living in detrimentally high population densities at the peripheries of the urban agglomeration, and the colored populations living in slightly lower densities also mainly at the urban periphery (Fig.7). In contrast the white population lives closes to the CBD and core of economic activity. Arguably this impacts the effects of employment and unemployment



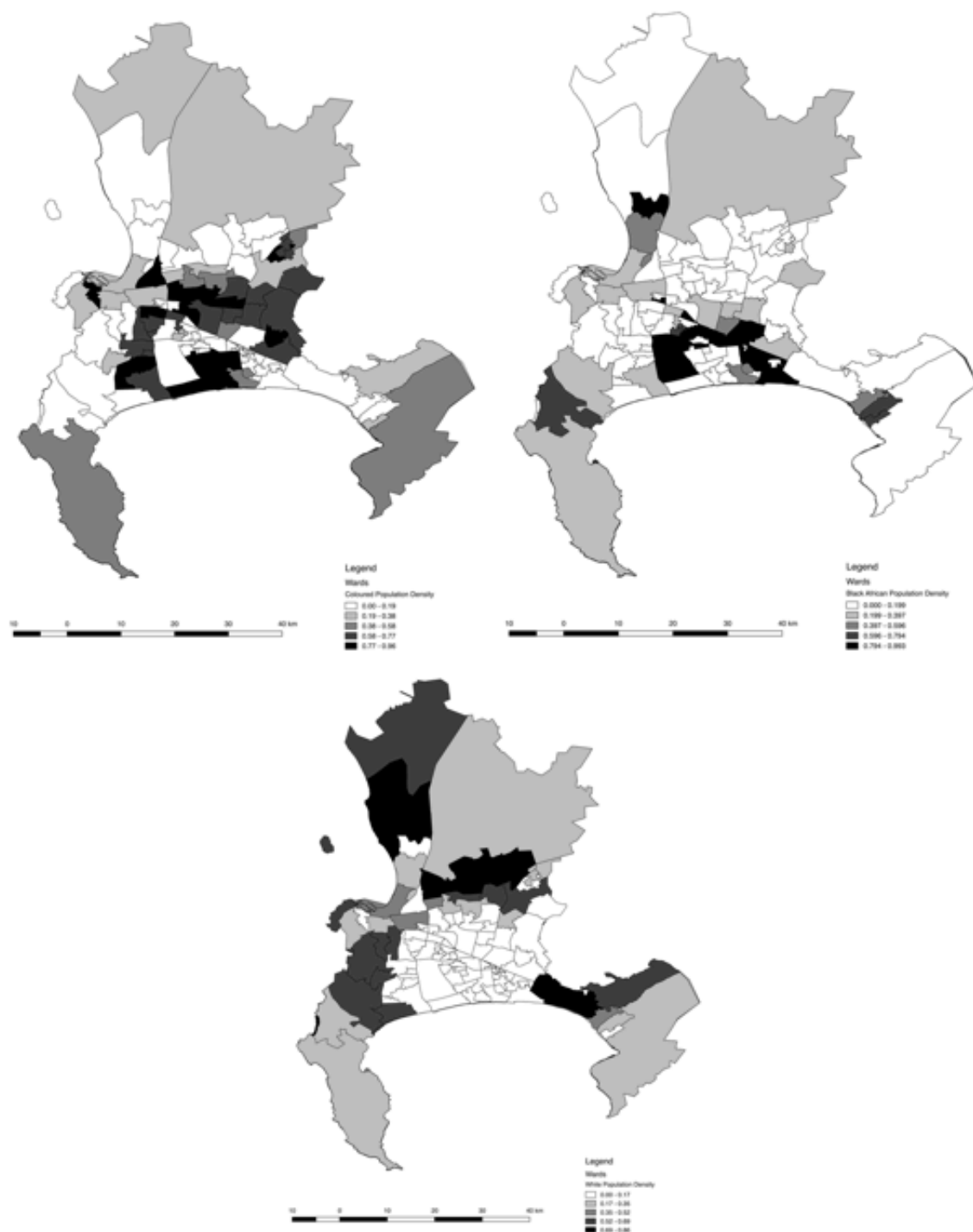
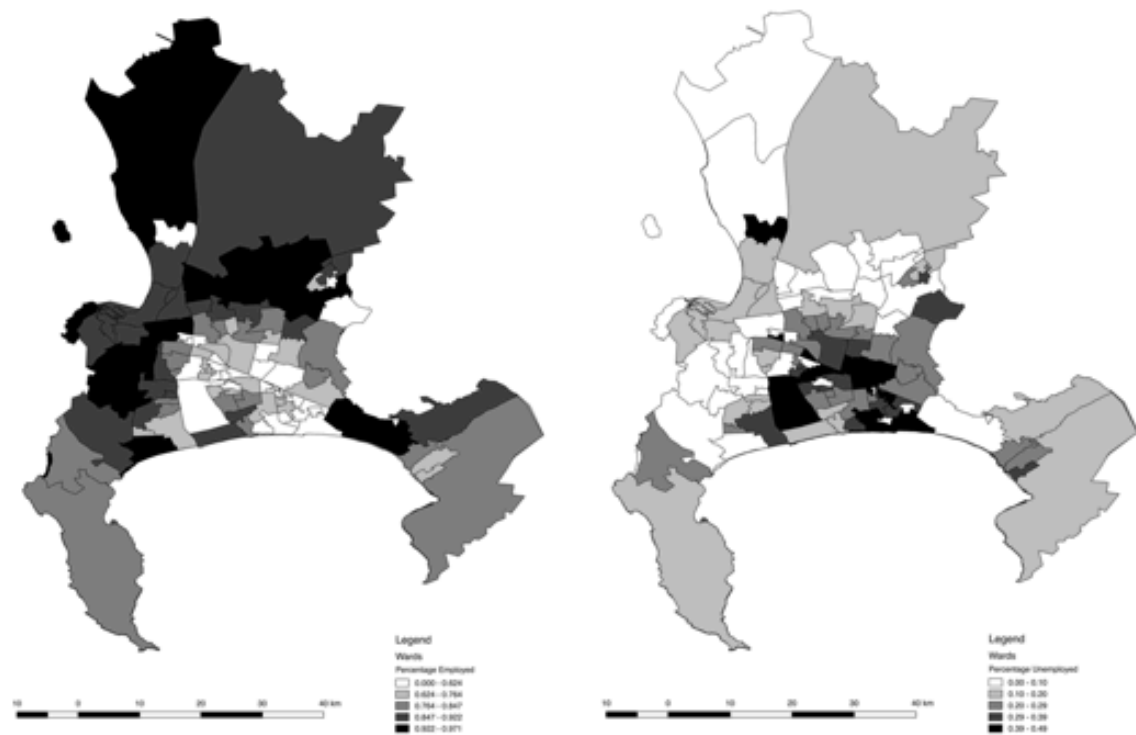
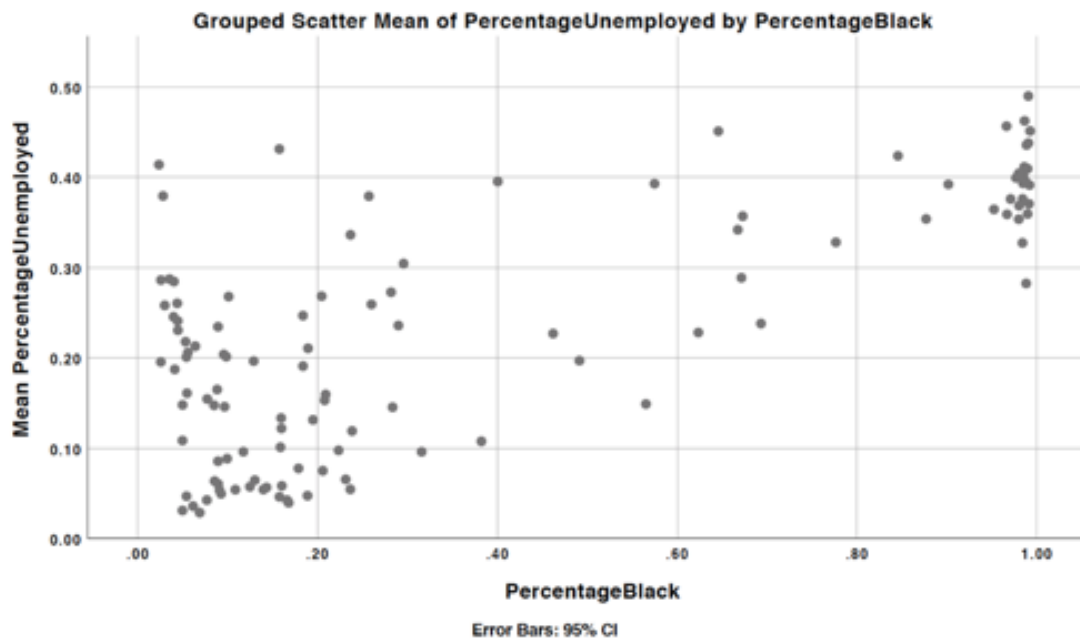


Figure 7-9: Population Density of Racial Groups by Wards in 2016 Cape Town (x)



*Figure 10-11: Percentage Employed (left) and Unemployed (Right) by Wards in 2016 Cape Town (x)*

(Fig.10-11). The spatial pattern of unemployment (Fig.11) follows precisely the pattern of highest density of black population. In this sense there seems to be a correlation between proximity of Black African populations, which needs to be held for density, as a result of distance from the CBD, leading to higher rates of unemployment (Fig.12).



*Figure 12: Correlation between density of Black African population and Density of Unemployed as categorized by Ward showing an linear increase in correlation.*

Holding for other variables, there is a direct correlation between the two, which through the research presented in this paper is likely to be linked with spatial and functional factors. Further research includes the need to correlate with proximity for societies located from the CBD and research the opportunity for transit-oriented development, a currently enthused spatial planning mechanisms, in re-appropriating apartheid fractions (City of Cape Town 2016).

## 5. Conclusions

This paper has presented an evaluative strategy and analytical tool for understanding the socio-economic impacts of apartheid planning and post-apartheid urbanism, through a spatial configurational lens. This is to provide greater insight for policymakers to understand the importance of spatial conditions on reiterating the opportunities for marginalized communities within the apartheid context, and encourage reflection over why current planning regimes may not be sufficient in reversing the problematic disassociation from natural centrality process with growth to the region. Further research into regional urbanism and worlding could be combined to create an even more powerful argument, to understand the disparity between land-use pattern and centrality as a process in this apartheid urbanism agglomeration (Roy 2011). The economic potential of the region is yet to be unlocked and could be manifested with reanimation of natural urban global centres and subcenters, which arguably needs to be the focus of planning discourse for South African planners.

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