[The Syntax of Spatial Transformation and Ethnic Conglomeration: How has ethnicity and language shaped Singapore's urban morphological structure today?]

by

[Francine Chan Wen Xin]

September 2021

Supervisor: [Dr. Kayvan Karimi]

A Dissertation submitted in part fulfilment of the

Degree of Master of Science (MSc) Built Environment

Space Syntax: Architecture and Cities

Bartlett School of Architecture

The Syntax of Spatial Transformation and Ethnic Conglomeration:

How has ethnicity and language shaped Singapore's urban morphological structure today?

Abstract

This paper intends to prove that *the underlying spatial logic of central Singapore has been shaped by the evolving ethnic discourse, and by extension, language.* Colonial racial ideology has been embedded in Singapore's spatial morphologies (Benjamin 1976; Hirschman, 1986). The administration of social boundaries through "inherent" dispositions of ethnicity (Rahim 1998: 239) was seen to have translated into spatial boundaries. This form of spatial administration resulted in levels of social and economic deprivation for ethnic minority groups until the period of independent governance. Afterwards, these divisive practices were addressed through education and housing policy reforms, translating into spatial reorganisation (Phua and Yeoh, 1998: 312). The first part of analysis shows the progress of Singapore's spatial logic through four periods in time. This is observed in a study of various ethnic enclaves alongside a control study of the historic downtown area, through historic timelines alongside space syntax segment maps. Findings have shown that the documented records of disparity can be seen through the unequal levels of mobility and movement within and between Singapore's various ethnic enclaves. The second part of this analysis addresses the present spatial scenario, where engineered multiculturalism introduces a new stage of understanding spatial heritage. Ethnic groups have since been spread out across new towns and ethnic enclaves act more as cultural hubs and commercial districts. Therefore, this section studies how residential patterns have been reorganised; how cultural identities are being retained; and the role language plays in spatially shaping current patterns of co-presence in the city. Findings show that residential areas are significantly less bounded by ethnicity. However, language, culture and ethnicity still maintain strong spatial identities in their respective enclaves, shaping co-presence and co-absence in the city. Singapore's current social reproduction still recognizes ethnically bounded categories which make up a public multicultural performance. As such, heritage and cultural identities are preserved through the spatial logic of ethnic enclaves - representative of a unified but ethnically diverse population.

Keywords

Space Syntax, Spatial Logic, Singapore, Historical, Ethnicity, Language, Enclaves, Urban Morphology, Spatial Identity, Spatial Heritage, Colonization, Racial Theory, Multiculturalism, Segregation.

Contents

List of Illustrations and Tables

Figures

Tables

List of Appendices

Acknowledgements

I would like to thank my supervisor, Dr. Kayvan Karimi, for being an amazing mentor and providing invaluable insight and supervision throughout this program. I am especially grateful for the generous amount of time and effort he has put in, especially during this difficult time. I would also like to extend this gratitude to the Space Syntax faculty of Dr Sam Griffiths, Dr Sophia Psarra, Dr Kerstin Sailer and Professor Laura Vaughan for their engaging lectures and dedication. I am especially thankful for the faculty's commitment towards providing a high standard of education through an engaging curriculum, even with the setbacks of the COVID pandemic. This year has been extremely fulfilling and inspired me to pursue a future which furthers my understanding of Space Syntax within the urban and architectural setting.

I would like to express my special appreciation towards Genevieve Shaun Lin for taking the time to generously share about her work and insights on planning and analysis in a Singaporean context. This also extends to the inspiring research shared by Ryan Tan and the extensive publications from the Centre for Liveable Cities Singapore which has contributed to the foundations of my research.

I would also like to thank Genevieve Shaun Lin, Po Nien Chen and Sepehr Zhand for their technical guidance and assistance throughout the course, which was especially difficult to achieve in a remote setting. I have gained a wide range of understanding for the technicalities of spatial and statistical analysis from your patience and guidance.

Lastly, I would like to thank my family and friends for their unwavering support. I could not imagine getting through this year of uncertainties and changes without everyone's understanding and support.

Chapter 1: Introduction

This paper intends to prove that *the underlying spatial logic of central Singapore has been shaped by the evolving ethnic discourse, and by extension, language.* Colonial racial ideology was embedded in Singapore's socio-economic boundaries (Benjamin 1976; Hirschman, 1986). Society was administered by "inherent" dispositions of ethnicity (Rahim 1998: 239), where boundaries were manifested through linguistic divide. This resulted in educational deprivation for ethnic minority groups in addition to spatial segregation leading to limited opportunities. Post-independence, these divides were addressed through education and housing policy reforms, translating into spatial reorganisation (Phua and Yeoh, 1998: 312). Language, culture, and ethnicity is shown to play a diverse but evolving role in shaping co-presence and co-absence in the city. However, there is a gap in research regarding how these socio-economic infrastructures are explicitly linked and interwoven within the spatial fabric of the city. Spaces act as the physical manifestation of ethnicity and language as tools of social engineering, playing different roles of segregation and unification through time. Therefore, the point of this research is to show exactly how ethnicity and language has played a role in Singapore's spatial logic and morphology. In addition, this paper also explores how this spatial logic still exists till this day in a different multicultural context. Singapore's current social reproduction still recognizes ethnically bounded categories which make up a public multicultural performance. As such, heritage and cultural identities are preserved through the spatial logic of ethnic enclaves - representative of a unified but ethnically diverse population.

The literature review will cover key aspects of Singapore's history, and significant periods of change within the ethnic socio-political discourse. This addresses the role of colonisation in establishing a racialized framework, and how this was later dismantled during the period of independence and decolonisation through the restructuring of language and housing in the country. In the methodology section, we address how locations were chosen, as well as methods of historical mapping, data collection and forms of spatial analysis along with their limitations. Next, we begin a two-part analysis firstly addressing historic change, and next, addressing the present multicultural urban framework. These findings will then lead on to part three, which acts as a discussion bridging the evidence to form a comprehensive understanding on how spatial logic has evolved to support the changing ethnic discourse. Lastly, we will conclude with an understanding of the roles which Singapore's urban fabric plays in shaping the social reproduction of the multiracial and multicultural city which it is today.

1.1 Hypothesis/Research Questions

The research goal is to understand the subtleties of spatial patterning driven by socio-political motivations. This will be conducted through a three-part analysis cumulating to a discussion on the hypothesis that **- the underlying spatial logic of central Singapore has been shaped by the evolving ethnic discourse, and by extension, language.** The research questions are split into three parts. In part one, the historic timeline of the ethnic discourse is compared alongside changes seen in segment analysis of historical maps. The aim is to determine if spatial logic was complicit in structuring a racially divisive urban framework. In part two, we look at the present map alongside census data, languages of signs, as well as other datasets documenting points of interests relevant to the ethnic discourse. We look at the success of dispersal of ethnic clustering in residential neighborhoods, alongside the presence of strong cultural identity in their respective enclaves today. Lastly, in part three, we discuss how historicity and post-colonial social engineering has shaped the ethno-spatial discourse of today. Therefore, the research questions are as follows:

1. How has the urban plan of Singapore changed through the course of history? Specifically, how has the social politics of Singapore been reflected on its evolving urban movement networks?

2. How has language and ethnicity shaped the spatial morphology of Singapore's historic centre today? This will be examined through datasets of ethnically and culturally significant landmarks.

3. How has the underlying spatial logic of central Singapore been shaped by the evolving ethnic discourse, and by extension, language?

Analysis will be structured primarily based on time periods following the change in ethnic discourse. This goes through three major stages: the establishment of ethnic division, the period of self-organisation within ethnic communities, and the reintegration of ethnic communities into a homogeneous society. This will lead to a discussion on present day spatial heritage and cultural preservation in historic ethnic quarters. The discussion will be in response to the original hypothesis on the underlying spatial logic being shaped by evolving ethnic discourse, and by extension, language. This will address the relevance of preserving spatial heritage considering population homogenization.

Chapter 2: Literature Review

In this section, we will be looking at Singapore's history, ethnic politics, linguistic and housing reforms, as well as more theoretical aspects and applications of space syntax theories in this urban study. We firstly focus on historical aspects relevant to Singapore's ethnic socio-politics, and how colonisation played a role in establishing a racialised socio-economic framework. We then move on to periods of decolonisation and how these ethnic and social divisions were addressed through language and housing reforms. Concluding, we look at how space syntax theories may be used as a tool in explaining the phenomenon of spatial logic and configuration in supporting and deconstructing these racialised frameworks.

2.1 Overview of Singapore's History

Historical research will be split up into four periods, each addressing different forms of governance or major shifts in the socio-political landscape. Each historical period sees a set of unique challenges which reflect upon the urban landscape as a result (National Library Board, 2014). The historical timeline is as follows:

1819 - 1826: Early Settlement: Immigration and Ethnic Segregation
1826 - 1867: Straits Settlement: Society and Division
1867 - 1942: Crown Colony: Language and Division
1945 - 1955: Post-War Period: Ethnic Reintegration
1955 - 1971: Self-governance: The First Masterplan
1971 - 1989: New Towns: Ethnic Regrouping

The **Early Settlement** period is characterized by the establishment of the British colony (Yeoh, 2002). Immigrants were being spatially divided and organized into ethnic quarters, proposed in an earlier town plan (Jackson Plan). The **Straits Settlement** saw Singapore emerge as an important trading post. The government was understaffed and unconcerned with the population's welfare, and infrastructure was largely funded by Chinese merchants (Lang, 2004). Growing power led to the establishment of Chinese secret societies, or triads - divided by dialect groups (NLB, 2015). The **Crown Colony** era revealed deficiencies in colonial administration (LePoer, 1989; Turnbull, 2009). Pressing social problems such as labour rights, secret societies and poor living standards were addressed under direct administration from London (Lim, 2008). The **Post-war** era after the Japanese Occupation fell into a state of violence and disorder. Urban infrastructure was destroyed, while locals were discontented with British rule (Wright, 1993). The first Singapore elections were also being held at this time (LePoer, 1989). **Self-governance** was established in 1955, but racial tensions were high between the Malay and Chinese population, leading to two major riots between 1963-1966 (LePoer, 1989; Leifer, 2009). Significant changes in planning and policy had to be made to ensure the welfare and social justice of the populace (Public Service Division, 2021; National Library Board, 2021). This eventually led to an educational linguistic reform and the first master plan of Singapore in 1971 (Chew,2009). Rapid urban growth began in 1971, termed **New Towns**. Singapore addressed problems of unemployment, housing, and education by constructing mixed-used residential towns (URA, 1991). The government also began ethnic regrouping by imposing ethnic quotas in new residential estates. This ensured that citizens moving out of

ethnic enclaves get evenly distributed throughout various residential estates, down to individual residential blocks (Phua and Yeoh, 1998: 312; The Straits Times, 17 February 1989).

2.2 Singapore's Ethnic Politics

With the influx of immigration, the population demographic became increasingly diverse. Although most of its early settlers were of Chinese and Malay descent speaking various dialects (Liu et al. 2004; Taylor 1994: 7). Society was subject to colonial organisation, where the population was racially administered Benjamin 1976; Hirschman 1986). The earliest census in 1824 recorded the population by ethnicity (NLB, 2014; Table.1). This embedded social-ethnic boundaries and inequalities within Singapore's early infrastructure. Racial groups were divided by occupational stereotypes based on "inherent" dispositions of race (Goh, 2008; Go, 2004; L'Estoile et al. 2005; Rahim 1998: 239), influenced by anthropological imaginations of the nineteenth and early twentieth centuries, which lent scholarly legitimacy to these representations (Asad, 1973; Fabian, 2014; Lee & Sacks, 1993; Ulin, 1975). The Europeans placed themselves in governing roles; the Chinese majority in trade and entrepreneurship; the Malay in rural economy or local administration; while the Indians were poorly paid labour (Kong and Yeoh 2003: 195-196). This racial division extended to spatial segregation firstly separated by station, public spaces, and housing. Then, a secondary separation of Asian populations through the provision of ethnic enclaves with further local division by language dialect (Hirschman 1986; Kong and Yeoh 2003).

PRECENT DISTRIBUTION OF POPULATION BY RACE, 1824-1967

Year	Chinese	Malays	Indians	Others	Total
1824	31.0	60.2	7.1	1.7	100.0
1830	39.4	45.9	11.5	3.2	100.0
1836	45.9	41.9	9.9	2.6	100.0
1849	52.9	32.2	11.9	3.0	100.0
1871	56.8	27.1	11.9	4.0	100.0
1891	67.1	19.7	8.8	4.3	100.0
1911	72.4	13.8	9.2	4.7	100.0
1931	75.1	11.7	9.1	4.2	100.0
1947	77.8	12.1	7.4	2.8	100.0
1967	74.4	14.5	8.1	3.0	100.0

Table 1: Singapore Census by Ethnicity (Saw, 1969)

Institutionalized pluralism was deeply embedded; referring to a society and system of government that has different groups of people retain their identities while existing with other segregated groups (Goh, 2008).

> *Singapore became a 'medley of peoples' that 'mix but do not combine', meeting 'only in the market–place' and 'living side by side, but separately, within the same political unit'.*
> *(Furnivall, 1948, 304).*

Furnivall's approach (Vandenbosch, 1948) was inspired by Durkheim's Division of Labour in Society (1893). Durkheim suggested that pre-modern and modern societies have distinct social solidarities brought about by the division of labour. Singapore's urban arrangement is better described through Hillier and Hanson's (1984)

Correspondence Theory. This is characterized by correspondence, or mechanical solidarity (Durkheim, 1893), which depends on local spatial interaction over the global. Meanwhile, non-correspondence or organic solidarity (Durkheim, 1893) depends on global socio-economic relationships dominating over local spatial interaction. Singapore separated the Chinese and Malays, confining the former to the modern economy based on organic solidarity as compradors of the capital; while the latter to politics and the rural economy based on mechanic solidarity (Goh, 2008). This separation was termed as 'differential solidarity' (Hillier & Hanson, 1984), indicating that movement patterns were governed by ethnicity and race in Singapore.

2.2.1 Decolonisation and the Reformation of Ethnic Politics

The decolonization of Singapore following the period of self-governance created a unique form of "nationalism" driven by multi-ethnic complexity (Anderson, 2006; Goh, 2008). Nationalist ideology in Singapore transformed race into a malleable concept for nation-building. The sudden need for a singular national identity did not go well for the previously separated ethnic communities (Maiello 1995). This led to riots between the Malays and Chinese due to ideological differences and racial inequality (Bass, 1986; Han, 2005). The Singapore government urgently addressed this by cultivating "racial hegemony" or the social, cultural, and ideological consent of multiple ethnic groups (Crichlow, 2013; Omi and Winant, 1994). In The Production of Space (Lefebvre, 1974), Lefebvre proposed a social theory of space consisting of 'spatial practice', 'representation of space' and 'representational space'. Representations of space would encompass all signs and significations, codes and knowledge allowing material practices to be understood (Harvey, 1990: 218; Stewart, 1994). Modern urban planning dispersed ethnic enclaves (Sin, 2003), while multiculturalism was enacted through the conceived space in everyday life, routinizing spatial practices and social relations reproduced (Giddens, 1985:272). As racial categorization was deeply embedded within the state, the spatial social reproduction of multicultural recognition was still bounded by race but scripted using language and housing to move beyond issues of tolerance into equal worth in society (Goh, 2008).

2.3 The Role of Language in Segregation and Reformation

Part of the division of ethnic society was achieved using language. This manifested in the language used in education and instruction, the language of educational and scientific resources, and the mode of instruction in employment (Lyut, 2009; Wong, 2007). This was a key part in how the state managed spatial correspondence, regulating interaction between different ethnic groups. Singapore's Anglo-Malay pacts recognized bound colonial authorities to provide for only Malay education in rural areas while establishing some English schools in town (Lee, 1993, pp. 3–19); Loh, 1975; Wong, 2007). Without state provision, the Chinese community began running their own schools in the 1820s, funded by the local community with external influences from China (Fatt, 1968; Gopinathan, 1974; Tan, 1997; Wilson, 1978). These ethnically based schools played a large role in ethnic segregation as they reinforced non-correspondence models (Hillier & Hanson, 1984) by being exclusive to speakers of specific languages, commonly predetermined by ethnicity or dialect. Each ethnicity also followed curriculums modelled from their original ethnic region in England, Malay Peninsula, and India respectively (Gopinathan, 1974; Loh, 1975; Watson, 1993; Wilson, 1978). Ethnic groups were further divided into those who spoke in their mother-tongue and those who were English educated. Culturally Anglicized citizens were more favoured by European and British officials. Within this period of educational and linguistic division, society was culturally and socially segregated (Rudolph, 1998; Yong, 1968).

This linguistic division began to change after the war, as colonial powers began to recede, locals had to take up management of the country (Lyut, 2009). The national library became free to all and included multilingual

catalogues with generous local donations (Lyut, 2009). Non-correspondent spaces relying on the organic solidarity of segregated ethnic groups began to break down from this point into a more homogeneous society. Several educational policies were also proposed to bridge the linguistic division between schools (Tarling, 1993; Wong, 2007). While initially met with opposition and infrastructural challenges (Liang, 2003), equalisation was achieved through linguistic 'cross-pollination' between schools, with most schools catering for at least two languages, and English taught across all institutions (PSLC, 3rd Session, 1953, 20 October, B322; SB, 22 October 1953; Wong, 2007). In addition, with a new generation of multilingual population, the culture of Singapore would begin to become more homogenous through ethnic and cultural interaction. Therefore, schools began to be much more spatially correspondent as access was now 'granted' to schools regardless of ethnic clustering or language barriers.

2.4 Ethnically Driven Housing Reforms

Education was not enough to address the issue of ethnic segregation as people were still spatially separated due to the division of ethnic enclaves. The Chinese around Chinatown; the Malays in Geylang Serai; while the Indians were more spatially dispersed in small groups around Little India as it is known today (Sim et al, 2003; Siddique & Shotam,1990). While these enclaves were broken up when the government cleared up the central areas for redevelopment, residents were choosing to resettle based on ethnicity (Sin, 2003). Therefore, the government imposed a system of ethnic quotas in social housing estates with effect from 1st March 1989. Public housing became the centre of ethnic reform (Guo, 2016), and a pervasive representation of spatial organisation in Singapore (Phua and Yeoh, 1998: 312). Ooi (1994) describes housing to be the configuration of the social and physical landscape in Singapore, representative of the country's vision of the relationship between society and space. The government embarked on this project with aims to reproduce a microcosm of Singapore's ethnic mix in every block, neighbourhood, electoral constituency, and New Town (The Straits Times, 17 February 1989). Therefore, Singapore has achieved to a certain extent the multi-ethnic engineering of a homogeneous society. Ethnicity, however, remains a large part of the Singaporean identity and the approach was not to remove ethnicity from its entrenchment within Singapore's societal dialogue. Ethnicity, in fact, has become an integral part of how the government and country's spatial policy's function.

2.5 Application of Space Syntax Theory

Space syntax theories would be extremely relevant in context to this research as it provides an insight into the underlying spatial logic and configurational structures of Singapore. Segment maps firstly reveals mobility networks through the analysis of historic maps. This gives us valuable information on how society and spaces were structured in the past, especially in the absence of detailed historic datasets. Additionally, the theory of co-absence strongly supports earlier mentioned patterns of social reproduction which manifest through lived spaces. This allows us to understand how different ethnic communities might get a chance to interact within a segregated spatial landscape.

2.5.1 Segment Maps

The segment map reveals the interconnection of spaces from their local to global structures (Hillier, 2009). Axial geometries represent syntactic differences within cities - a reflection of their spatial culture. This can be explained through the permeability of public and private spaces based on location, or the integration of public and private dwellings in relation to the urban fabric. Segment maps are a development of axial lines considering intersections, with additional topological, metric, or angular changes. This maps out urban

movement networks and its social reproduction (Hillier and Hanson, 1984; Hillier, 1996; Hillier, 2002; Liu & Jiang, 2012). Segment analysis can be understood through the measures of integration and choice. Integration measures the to-movement potential of a segment, or potential destinations on an urban grid. This considers spatial accessibility, or how easy it is to reach from all other segments. Choice, meanwhile, measures through-movement potential, or its potential as a route from all segments to all others (Hillier and Hanson, 1984; Hillier, 2009). Integration and choice measures are integral in identifying movement related structural patterns in cities since it considers the probabilities of destination and route models and other functional correlations (Hillier, 2009).

2.5.2 Co-presence

Patterns of movement gained from the axial analysis can also be studied through patterns of natural co-presence in public spaces. This means that spatial opportunities are provided for social and cultural exchange (Hillier, 1996; Hillier and Vaughan, 2007). This builds upon the theory of centrality which accounts for a significant proportion of movement through urban streets, determined by grid structure (Rokem and Vaughan, 2017). Hillier also proposes that a correlation between the mathematical values of integration and choice might 'index the degree of "movement interface" between inhabitants and strangers' (Hillier et al. ,1987: 237). This proposition was tested in London where it was found that the peak intersection between integration and choice occurs in locations with the highest land use diversity (Vaughan, 2015; Vaughan et al., 2010). Therefore, key points of encounter and thus, co-presence can be modelled based on crossovers between to and through movement in the city indicating higher levels of accessibility and interaction (Rokem and Vaughan, 2017).

2.6 Conclusion of Literature Review

In conclusion, there has been extensive literature documenting the ethnic organisation and their spatial segregation through the course of Singapore's history. This highlighted two main ways which people were spatially organised – through linguistically based communities and an educational framework which supports this divide; and housing segregation through ethnic enclaves. These two factors combine to form a racialised framework of spatial socio-economic segregation in the earlier parts of Singapore's history. The reversal of this segregated approach was likewise documented through the dispersal of ethnic spatial groupings and the reassessment of a divided education system. This reorganisation forms the basis of the multicultural social engineering which we see in Singapore today. Many of these spatial changes underlie the basis of Singapore's urban morphology. Space syntax and other forms of urban data analysis will act as a tool for this paper to develop a comprehensive methodology to assess these changes spatially, while understanding the logic behind these forms of organisation and reforms.

Chapter 3: Methodology and Data

This paper deconstructs the spatial logic of Singapore's planning and how it has been derived from its history of ethnic politics. Methodology adopted (Table.2) will maps different time periods to be analysed for their syntactic configuration and compared alongside changing urban morphology. Space syntax analysis, alongside other forms of urban data will be used to reveal hierarchies and relationships between the urban network, points of interests and land uses which shape the primary city activities. Changes seen in the urban landscape will be compared alongside political change and planning policies pertaining to the ethnic and racial discourse. This is also reflected through the management and use of language to organize and document different social groups (Lyut, 2009). This is with the intention of revealing the influences certain policies or ideologies had on the arrangement of power, society, and politics through spaces. This approach can also be seen in Hanson's study of London after the great fire of 1666 (Hanson, 1989); and the study of Karachi and how language, ethnicity and politics played a role in shaping the planned urban discourse (Khan, 2017).

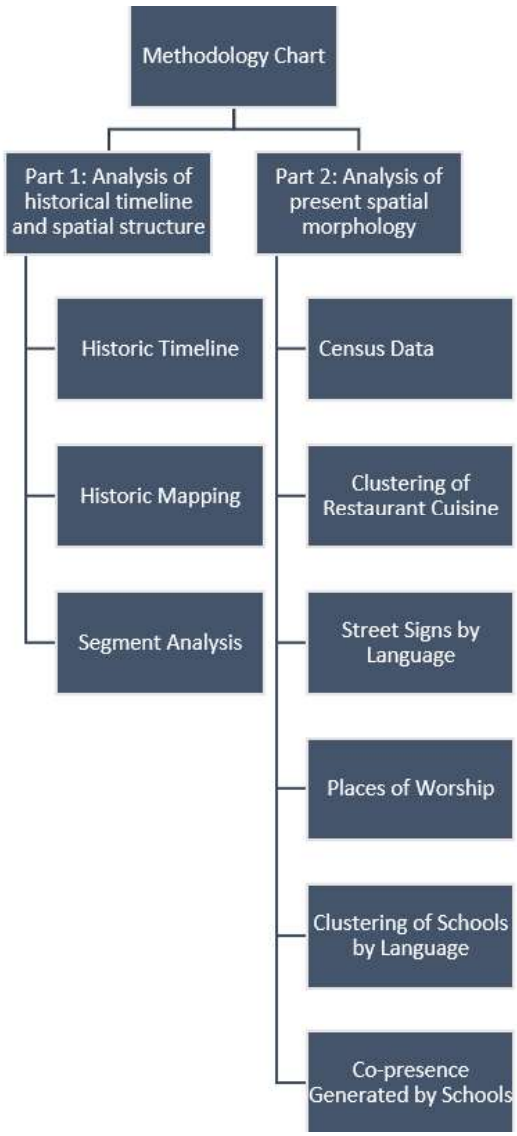


Table 2: Methodology used in this study

3.1 Location and Case Studies

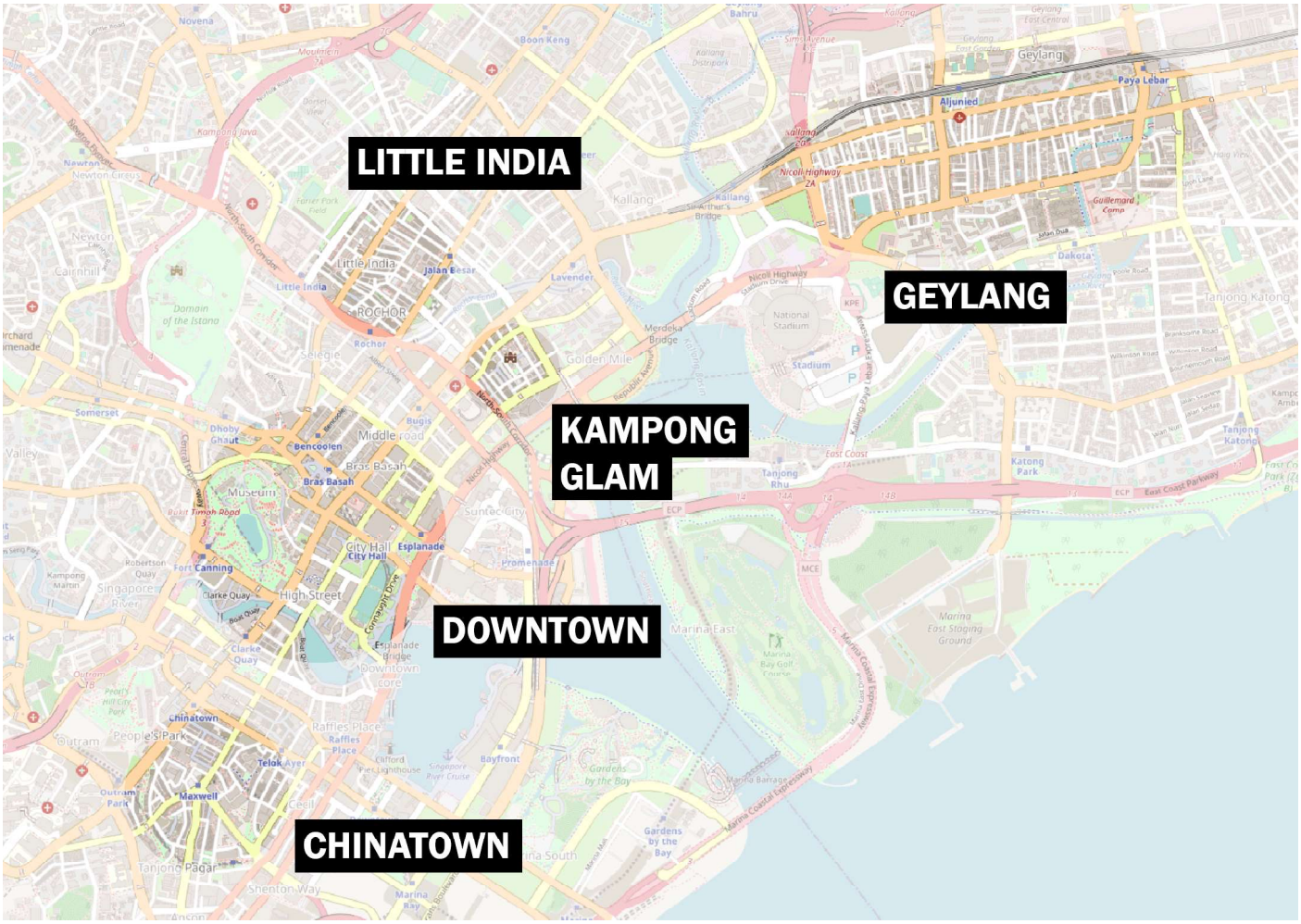


Figure 1: Labelled Map of Historic Centre

This research will focus on several ethnic enclaves and villages located around the city centre (Fig.1), to understand the role language and ethnicity has played in their creation and evolution. The centre of Singapore surrounding the seat of government at Fort Canning Hill will be used as a control study. This centre eventually developed into the main commercial and business district of Singapore. On the other hand, ethnic quarters remained mostly left to their own devices (Turnbull, 2009), with their organic growth reflected in the present-day cultural hubs. Therefore, it would be an important benchmark in observing the differences between planned spatial intentions and the contrasting - mostly organic ethnic quarters. Collectively, these would inform the socio-political and economic contexts of selected ethnic enclaves through the years, which would have influenced the social logic of spatial organisation. The following chart (Table.2) maps the selected enclaves of study, alongside the main ethnicities who resided in these areas:

Enclaves	Ethnicity	Sub-Categorizations
Chinatown: Chinese (Divided by province and dialect)	Chinese	**Province, Dialect, Trade** The Cantonese occupied Temple Street. The Hokkiens were located in Telok Ayer Street and Hokkien Street, while the Teochews were settled in South Canal Road, Garden Street and Carpenter Street. Small communities of Indian traders around the junction of South Bridge Road and Upper Cross Street; Indian temples and Muslim mosques can be found in the area too.
Kampong Geylang: Malays, Orang Laut	Malays, Orang Laut	**Trade, Labor** Malays relying on land for agriculture populated Geylang Serai. Chinese and their commerce took up the western 'lorongs'.
Kampong Glam/Bugis: The Sultan's residences, Malay, Bugis, Arabs, Javanese, Boyanese	The Sultan, Malay, Bugis, Arabs, Javanese, Boyanese	**Muslim Religion, Trade, Labor** Kampong Dalam was reserved for masons and blacksmiths. Pahang Street for stone masonry practiced by Javanese and Chinese (Hokkiens and Teochews).
Little India: Indians	Indians	**Trade, Labor** Chinese community congregated around Syed Alwi Road and Balestier Road areas, largely involved in farming and plantation activities. The Javanese lived at Kampong Java, while the Baweanese and Indian Muslims established themselves at Kampong Kapo
Downtown Singapore (Control)	Europeans, Locals	**Civic, Commercial** Downtown Singapore was reserved for civic and commercial developments in the 1822 Town Plan, occupied by the civil service, government offices as well as large commercial offices and markets. It was originally surrounded by European Town - an enclave reserved for european merchants and government representatives. Over time,this area became premium residential land for wealthy merchants (regardless of ethnicity). It also housed the majority of state sponsored and private schools.

Table 3: Ethnic Enclave Overview of Ethnicity and Spatial Categorisation.

(Cornelius-Takahama 2005a; URA 2021; Cornelius-Takahama 2005b; Chinatown Singapore 2021; Cornelius-Takahama 2004; Low et al. 2021; Mittal 2017; Ong 2009; Singapore Statutes 2017; Kampong Glam 2020; Ramlan 2011)

3.2 Methodology of Spatial Analysis Part 1

3.2.1 Historical Timeline of Socio-ethnic Evolution

The overarching spine of this research will be based on a consolidated historical timeline. This is analysed alongside spatial maps that deconstruct the spatial logic of historic Singapore through movement structures. The historical timeline will be referenced from historical records of Singapore Library, the National Heritage Board and supplemented by other historical texts (references in bibliography). From there, a compilation was produced for this research which documents significant political events, ethno-political outcomes and the effect it had on urban development. In addition, the histories of specific ethnic enclaves were also documented alongside - recording significant socio-political or economic changes in those areas. This timeline will be used to select significant periods in Singapore's spatial history where historical maps will be used to prove spatial changes.

3.2.2 Historical Mapping and Segment Analysis

Historical maps from the national archive have been digitized into analysed segment maps through the measures of normalized choice and integration. Maps are selected to be analysed based on their historic significance and the integrity of data collected. The digitization process begins with geolocating and scaling historic maps to more accurate present-day coordinates through roads and referenced landmarks. The present model of Singapore is then modified to depict the networks from these historical maps. This will be assessed at radius 400, 2000 and n, at a local, regional, and global movement scale. Local and regional scales will be prioritized when assessing pedestrian accessibility pre-1990s. This is because they are representative of the levels of pedestrian mobility before island wide public transport was readily accessible (NLB, 2021). Movement structures at these scales reveal significant patterns of Singapore's social reproduction from daily life, education and work for people living within and traveling out of those spatial clusters. Statistical analysis of each enclave through different time periods will also supplement this study to compare changes in accessibility or movement patterns.

3.3.3 Limitations of Historic Data

While the current methodological approach should serve to build a rigorous analysis on the spatial logic of Singapore's urban morphology, there are certain limitations. This is especially the case when working with historic data, with limited information on points of interest such as schools or kampongs at the time. Historic maps are also often unreliable in accurately capturing clear enough details of landmarks or building boundaries. To address this, the clearest map containing the most accurate street networks spanning the whole of central Singapore will be used for each time period, while additional maps and library records of that period might be used to supplement data on historic points of interest. Even so, this might not be the most accurate. Therefore, part 2 of this analysis will use census data and present points of interests obtained from OSM data. This is to further inform Singapore's present spatial logic and verify that the ethnic spatial organisation of the past still exists till this day.

3.3 Methodology of Spatial Analysis Part 2

3.3.1 Points of Interests and Census Data

A combination of spatial point data will be used alongside analysed segment maps to justify the logic of spatial organisation in the present historic centre. We will look how successful the Ethnic Integration Policy has been by comparing present census data of each enclave and verifying it through the clustering of restaurants with specific cuisines. This compares both the residential statistics by ethnicity and the social-spatial reproduction of these areas through restaurants. Next, we will assess how well these ethnic enclaves have preserved their cultural identities by looking at available places of worship and site observation data on different languages present on signs in each areas' high street. Datasets obtained from OSM or data.gov.sg selected include schools - categorized by language; places of worship - by religion; restaurants - by cuisine type; and signages - categorized by language. Historical datasets such as schools based on language of instruction were obtained through a combination of Singapore's national archives and documentation within historical maps. Lastly, signage languages were based on site observations - conducted through google street view considering the COVID situation.

3.3.2 Clustering Measures

In addition to statistical analysis, heavily populated datasets such as restaurant by cuisine types will also be analysed to look for patterns of spatial clustering. This is done through K-means clustering - an iterative algorithm that identifies clusters within a set of points (Lloyd, 1957; MacQueen, 1967). This measure identifies centres where specific cuisine types congregate, indicating points where ethnically based social reproduction might be condensed at.

3.3.3 Documentation of Languages on Signs

Street and retail signs have been identified along the main streets of ethnic enclaves (fig. 2). They are then catalogued based on languages observed. Singapore is a multilingual society, therefore, there are four main languages used officially – English, Mandarin, Malay, and Tamil. The categorisation of languages identified will follow accordingly, with an additional classification 'others' for other identified languages, and 'mixed' indicating two or more languages identified.

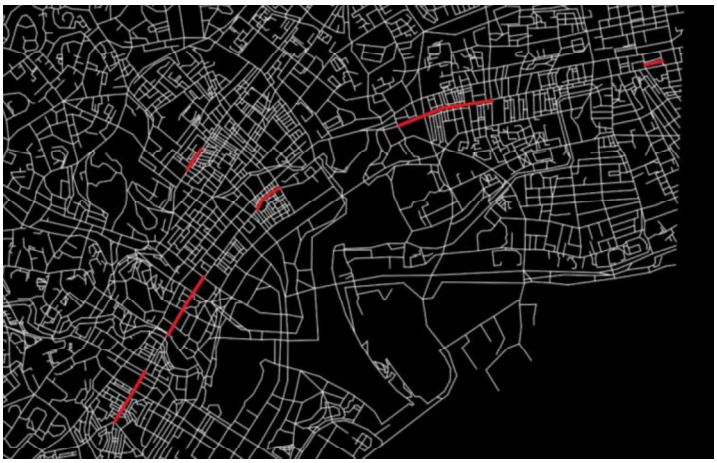


Figure 2: Identified Main Streets - highlighted in red (Language count on signs)

3.3.4 Historic Schools and Linguistic Education

Schools in Singapore were classified by language-based education, segregating communities of different linguistic backgrounds (see section 2.3). Schools of different languages would have played a role in spatially bringing people of different communities together if were located within proximity to each other, or in other enclaves beyond their community base. Therefore, it was imperative to collect as much data on individual schools and their historic location and language of instruction to identify patterns of spatial copresence. This methodology compiles records of historic schools from the national records (National Library Board, National Archives), which documented major schools and changes in location and languages taught. This was then identified as points on the present map with their taught languages to look at the spatial distribution and availability of education of different language - and ethnic groups.

3.3.5 Determining Levels of Co-presence

To analyse the relationship between language and patterns of co-presence (refer to chapter 2.5), we will look at historic educational institutions with different languages of instruction - Chinese, English, Malay, and Tamil. This will be compared alongside the present network of Singapore by correlating choice and integration values to determine levels of co-presence. The presence of higher R squared value on a linear regression chart between integration and choice would be indicative of higher levels of co-presence. Combined with the presence of different educational institutions, this means that people from different ethnic communities will be drawn into these locations and interact spatially.

3.4 Conclusion of methodologies

Part one establishes a methodology which compares key points in Singapore's historic ethnic discourse against the analysed maps of four corresponding time periods. Movement network analysis of different enclaves will reveal certain biases of early colonial planning and its future evolution. This is relevant in dissecting how current day planning has attempted to correct this ethnic social division or to preserve spatial heritage in certain areas. Meanwhile, part two utilizes data on racially based census and points of interests linked to ethnic or cultural communities such as restaurant cuisines, language of signage, language-based schools, and places of worship. This dataset will inform a statistical understanding of how Singapore's present urban morphology is being or has been influenced by ethnically based spatial organisation. It will will also inform an understanding of how spaces have been reorganised to enable a multicultural spatial landscape, or how the cultural identities of historic enclaves are being preserved. The intended outcome would be to understand how the ethnic discourse of the past has evolved and shaped present-day Singapore. This will be extremely beneficial in uncovering the historicity of current day planning, and how the intentions of the past have been absorbed or adapted to the present urban system.

Chapter 4: Analysis of historical timeline and spatial structure

Here, we will investigate how the urban form of Singapore has changed the course of history, and more specifically, how social politics has been reflected on its evolving urban movement networks. In this part we will be focusing on historical maps which act as a physical depiction of key historical events leading to the spatial organisation of Singapore's city centre. Each of the selected timelines represents historical periods of significant spatial change concerning ethnic politics (refer to chapter 2.1). Historic maps will play a role in dissecting the present spatial logic of Singapore's urban networks (Table.4).

Ethnic Historical Timeline	**Original Timeline**
1819 - 1867: Ethnic Division	1819 - 1826: Early Settlement: Immigration and Ethnic Segregation 1826 - 1867: Straits Settlement: Society and Division
1867 - 1945: Self Organization	1867 - 1942: Crown Colony: Language and Division
1945 - 1989: Reintegration	1945 - 1955: Post-War Period: Ethnic Reintegration 1955 - 1971: Self governance: The First Masterplan 1971 - 1989: New Towns: Ethnic Regrouping

Table 4: Categorization of Singapore's' Timeline by Ethnic Organisation

4.1 Ethnic Division (1819 - 1867)

Beginning each part of this analysis is a historic overview of this period. In this table, key ethno-political events, their outcomes, and the resulting urban development is recorded. In addition, a more detailed look into events happening within ethnic enclaves or the downtown centre is also recorded and coded by colour (fig.3).

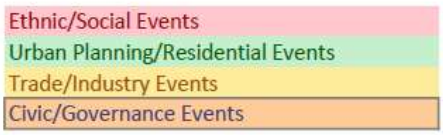


Figure 3: Representative colours in the historic tables

This period marks Singapore's initial establishment under colonial rule (Table.5&6), and when ethnic division of space was established. This is evident in the ethnic spatial segregation of the 1822 Jackson Plan or Raffles Town Plan (Fig.4); the establishment of ethnic categorization in the first official census (NLB, 2021); and the allocation of land within ethnic enclaves for specific forms of residential and trade uses (Kong and Yeoh 2003). The allocation of land played a major role in the ethnic classification of social roles which members of different ethnic origin may participate in. Establishment of Chinese secret societies further separated the majority Chinese society by dialect and regional origins. This governed local territorial rule and monopoly over major farming, labour, and entertainment industries.

Period	1819 - 1826: Early Settlement			
Society Overview)	Immigration and Ethnic Segregation			
Year	1819	1822	1824 - 1826	
Event	Singapore Treaty	Raffles Town Plan (Jackson Plan)	Treaty of Friendship and Alliance	First and Second Census
Politics	British East India Company sets up trading post	The first official urban plan around the trading port.	This treaty put power more firmly in the hands of the British.	Census was taken to account for the new influx of immigrants.
Ethno-political Outcomes	Influx of Malay and Chinese immigrants	Racialized socio-economic framework.	Influx in immigrants, extending to India, Indonesia and SEA.	Categorizations made by ethnic groups
Urban Development	Improved trade infrastructure.	Communes and spaces were allocated according to ethnic profile.	The British gained control over the areas beyond the port.	Ethnic and language dialect categorization and seperation.
Chinatown: Chinese (Divided by province and dialect); Indian traders		Area allocated for Chinese settlement.	Housed 1/3 of Singapore's population	Rapid population growth leading to urban slums.
		Self organized based on ethnicity, dialect and types of trade.	Start of Ghee Hin (Hokkien), Singapore's first chinese secret society, to provide accomodation, jobs and security for new chinese immigrants.	
Geylang: Malays; Orang Laut; Chinese traders	The Alsagoff family owned most of the land for the cultivation of lemongrass.			
Kampong Glam: Muslim community and streets organized by trade	Istana Kampong Gelam was built		Land allocated for Sultan Hussein Mohamed Shah and company.	Chinese, Bugis, Arab, Javanese and Boyanese villages.
Little India: Indians; Chinese laborers; Javanese immigrants	European residential enclave. Ethnic villages. Trade/Industry categorization based on ethnicity: Chinese, Indonesian, Indian Muslims, Indian immigrants, Indian Convicts			
Downtown: Old civic quarters.	Temenggong of Johor occupied the Old Parliament House	The Fort Canning area was reserved for government use and European merchants.		

Table 5: Historic Timeline, Early Settlement (1819-1826)

Period	1826 - 1867: Straits Settlement						
Society Overview)	Divided by ethnicity and labor.						
Year	1826	1826-1830	1831 - 1839	1843 - 1845	1846 - 1850	1851	1854 - 1866
Event	Straits Settlement	Chinese Population Growth		Police Force (Police Act 1956)			
Politics	Singapore becomes a British colony.	Chinese had become the largest ethnic group.		The growing presence of triades pushed for a police reform.			
Ethno-political Outcomes	Local population suffered without healthcare, housing and sanitation.	Large influx of poor and uneducated Chinese migrant workers.		Limited success in surpressing triades as they were extremely powerful.			
Urban Development	Society and infrastructure was left unmanaged.	Chinatown area became grossly overcrowded.		Police stations were installed along the coast to suppress piracy. A detective department was also established to combat secret societies.			
Chinatown: Chinese (Divided by province and dialect); Indian traders	Rapid population growth leading to urban slums.			Expansion of homes and trade		Urban slums	
	Ghee Hin began controlling the plantations, along with rice trade, opium farms and vice industries.			Rival societies of different dialects emerged, violence in Chinatown.		Riots spread, between Chinese Christians.	Hundreds killed or injured.
Geylang: Malays; Orang Laut; Chinese traders	The Alsagoff family owned large lemongrass plantations			The Malays and Orang Lauts resettled along river shore.			
Kampong Glam: Muslim community and streets organized by trade			Kampong Glam was built				
Little India: Indians; Chinese laborers; Javanese immigrants	European residential enclave. Ethnic villages.						
	Ethnic segregation of jobs continued		Cattle trade and related economic activities established as a predominantly indian trade.				
Downtown: Old civic quarters.		The first British Parliament House established	1836: St Andrew's Church built.	1845: The Singapore Library built.	Parliament House converted into courthouse.		1862: The first Town Hall was built

Table 6: Historic Timeline, Straits Settlement (1826-1867)

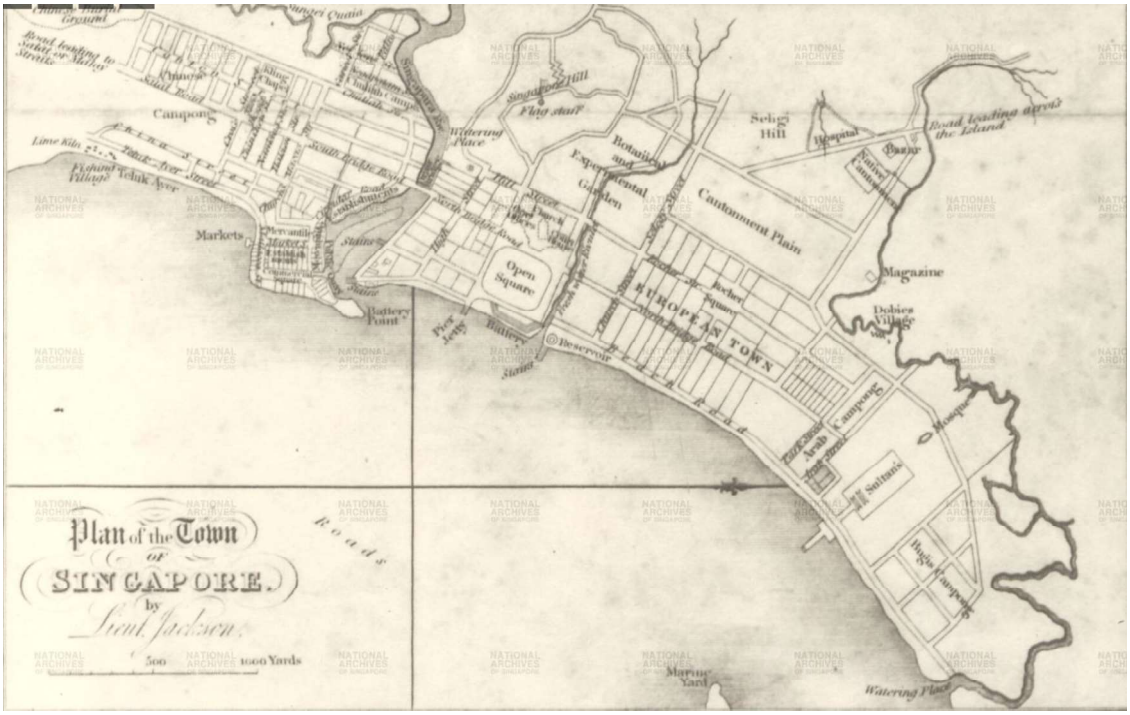


Figure 4: Jackson Plan 1822 (National Archives, 2021)

4.1.1 Spatial Network Analysis

In the 1846 integration and choice maps, the red lines represent the top 10% quantile values of street segments. Little India and Geylang lack urban development with fragmented local integration (fig.5). The north-eastern part of Downtown towards Kampong Glam - or the Sultan's residences at the time was an exception. Meanwhile, Chinatown was well connected to Downtown on a local scale (fig.6), indicating correspondence structures between these two areas. On a regional 2000m scale, Downtown and Chinatown both had higher values of integrated and choice routes (fig.7&8). Geylang also had a main road which connected the city centre to the plantations along the outskirts. Chinatown, Downtown and Kampong Glam each contained segments with the top 10% of choice routes, while Little India and Geylang were underdeveloped and isolated (fig.6&8). This supports earlier records that the Indian and Orang Laut/local Malay communities were more spatially dispersed out of all the ethnic groupings (Sim et al, 2003; Siddique & Shotam,1990). These network models indicate that ethnic social groups were organized to limit mobility, particularly in the Indian and Malay enclaves. Based on the above historic timeline, we know that the modern economy supports a non-correspondence model, where organic solidarity exists within the Chinese and European communities. Therefore, through this spatial study, we can prove that the division of organic and mechanical solidarity exists, organizing different ethnic enclaves into separate forms of correspondent local, and non-correspondent global spatial configurations. This generated an outcome of inequality and exclusion (Kwan and Schwanen, 2016: 248). Also, the levels of immobility within the Indian and Malay enclaves would also imply the lack of access to employment opportunities (and later, education), leading to social exclusion (Leitner et al., 2008; Massey, 1994).

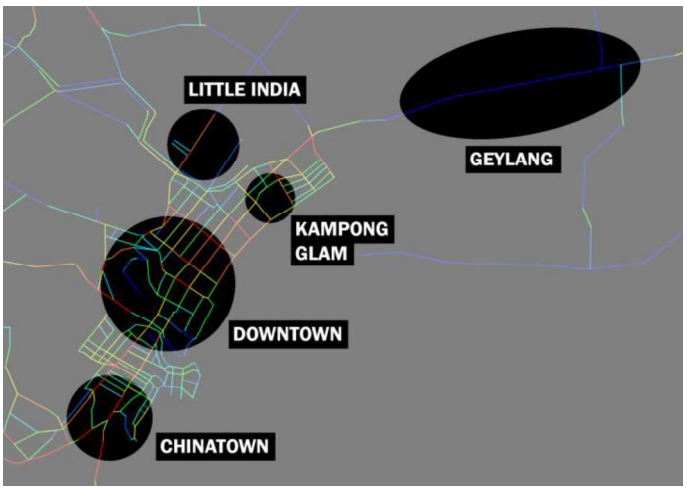


Figure 5 1846 NAIN 400

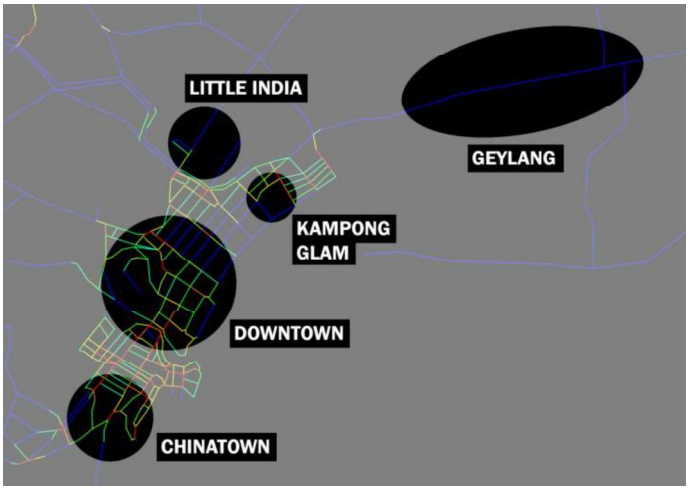


Figure 6: 1846 NACH 400

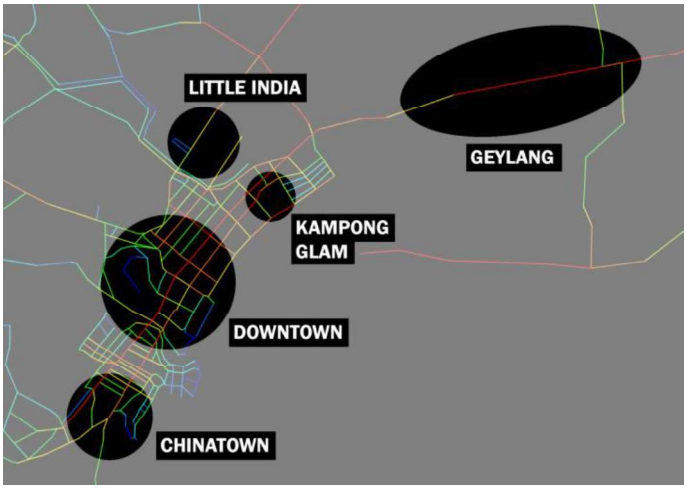


Figure 7: 1846 NAIN 2000

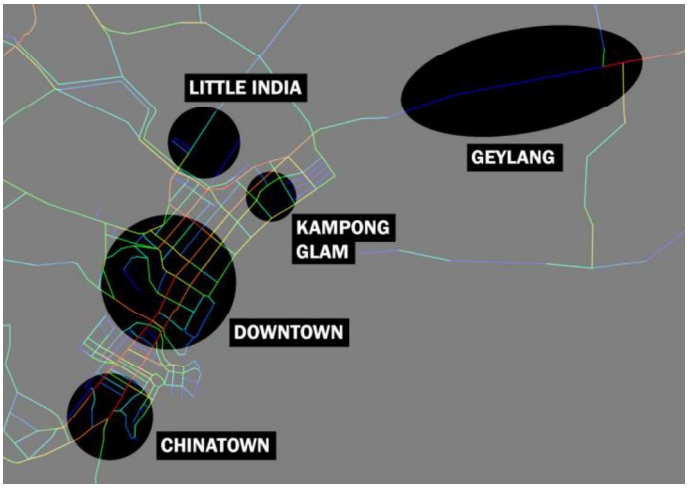


Figure 8: 1846 NACH 2000

4.2 Self-Organisation (1867 - 1945)

This period (table.7) was strongly influenced by Chinese politics and the revolution happening in China. The Chinese Protectorate was established, weakening the rule of Chinese secret societies. Due to the self-organized education system privately funded by Chinese merchants, many educational institutions supported and promoted the Chinese revolution. The Chinese also expanded into Geylang, Kampong Glam and Downtown through trade. Up until the Japanese Occupation, Chinese influence grew and spatially ruled over most of central Singapore. Meanwhile, there were also recorded changes in Little India and the Indian economy. The Indian community had established a monopoly over the global bullock trade, concentrated along the fringe roads between Little India and Kampong Glam. Indian merchants also established a strong local economy trading goods and provisions.

Period	1867 - 1942: Crown Colony (Language and division)							
Society Overview)	Divided by language, dialect and ethnicity .							
Year	1867	1877 - 1889	1889 - 1899	1900 - 1905	1906 - 1911	1911 - 1930	1930 - 1942	1942 - 1945
Event	Crown Colony	Chinese Protectorate	Ban of Secret Societies		Tongmenghui			Japanese Occupation
Politics	Direct administration of the Crown.	Welfare of the Chinese community.	Secret societies were forced underground.		Revolution to overthrow the Qing Dynasty.			World War II - Japanese occupation.
Ethno-political Outcomes	Asian council members gradually increased.	Protected Chinese laborers and women.	Ethnically based societies continued to exist illegally.		Strongly supported by Chinese immigrants.			Massacres and executions carried out.
Urban Development	Local conditions improved.	Weakened secret society's influence.	Decreased territorial rule by Chinese secret societies.		Revolutionary schools and libraries established.			Buildings repurposed as hospitals and shelters.
Chinatown: Chinese (Divided by province and dialect); Indian traders	Urban slums					Severe overcrowding reported		
	Secret societies.	Protectorate weakened the rule of Chinese secret societies.						
Geylang: Malays; Orang Laut; Chinese traders				The lemongrass industry failed.	Chinese residences and trade moved into the west. Malays moved east.		Entertainent district.	Residents began planting tapioca.
Kampong Glam: Muslim community and streets organized by trade				Organization by trade and ethnicity	Publishers of Islamic literature.	Red-light district	Chinese schools moved in.	
Little India: Indians; Chinese laborers; Javanese immigrants			Trade and business center for Indian immigrants - large influx of migrants.					
	Cattle trade and related economic activities established as a predominantly indian trade.			Swamps drained, cattle trade ended.				Wealthier settlers returned to India
Downtown: Old civic quarters.	Government Office was built	1887: Raffles Hotel was established	1891: The first fire station was built	1905: Victoria Concert Hall built	1906: Modern chinese school was set up.	1929: City Hall was built.	1939: Supreme Court built	City Hall became Japanese HQ.

Table 7: Historic Timeline, Crown Colony (1867 - 1945)

Ethnic/Social Events
Urban Planning/Residential Events
Trade/Industry Events
Civic/Governance Events

4.2.1 Segment Analysis

The spatial network of 1914 can be seen to reflect the above changes. Likewise, we will focus on local to regional scales. Firstly, we can observe the local fragmentation of Chinatown into separated local clusters (fig.9). This corresponds to the severance and self-organisation of the enclave with a central Main Street. However, its regional connections to the City Centre remains strong (fig.11), indicating the prevalence of Chinese society in the modern non-correspondent economy. Meanwhile, Downtown's local and regional centre seems to be expanding towards Little India and Kampong Glam (fig.9&11). New choice routes in the top 10% of value have also been added towards the Little India enclave (fig.10&12). This can be explained by the introduction of commerce from Indian merchants, the periphery areas of Little India gravitated towards Downtown to form an area of high local and regional integration values, indicating a merger into both the regional and local system. Therefore, the Little India enclave is now being supported by both correspondent and non-correspondent social and spatial relationships. However, Geylang continues to be underdeveloped

and populated by informal settlements without a clear local structure or connections (fig.9). While it has high levels of regional integration (fig.11), indicative of the high numbers of dispersed settlements along the route (fig.13), it remains poorly connected to the city centre, and a segregated community.). Ethnically based differential solidarity (Hillier & Hanson, 1984) can be seen through these observations as different ethnic enclaves and their respective social groups had different levels of local and regional accessibility.

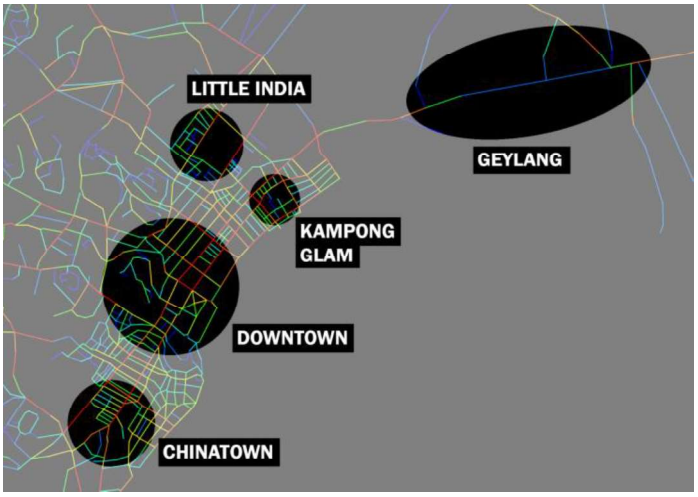


Figure 9: 1914 NAIN 400

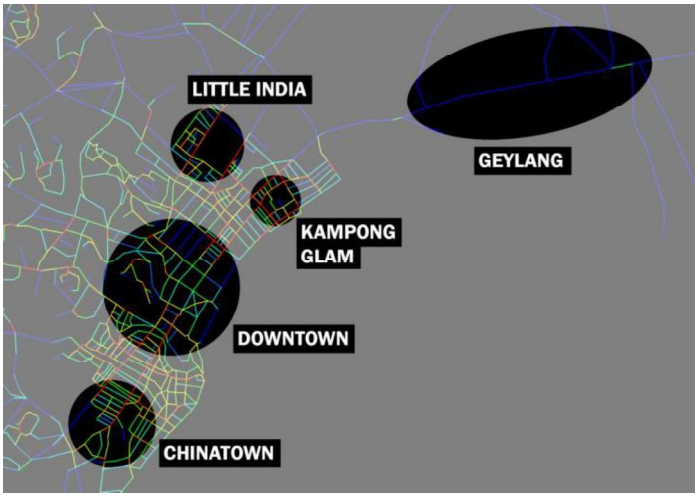


Figure 10: 1914 NACH 400

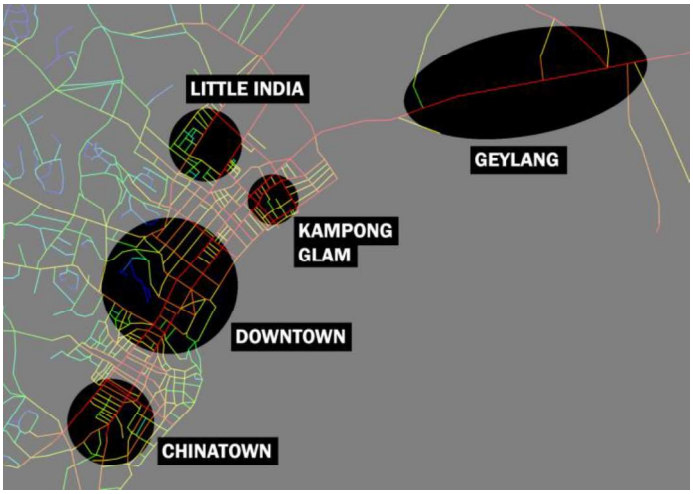


Figure 11: 1914 NAIN 2000

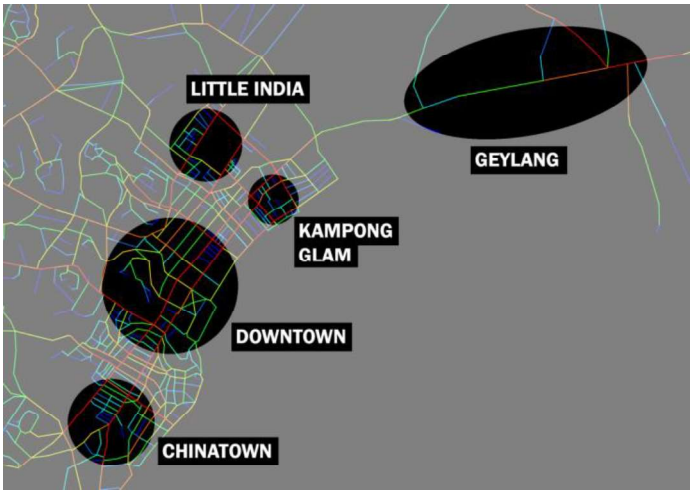


Figure 12: 1914 NACH 2000

Figure 13: 1914 Map of Kampong Glam to Geylang Area (National Archives, 2021)

The changes observed in the 1914 network analysis indicates that Singapore Town has established a global and local centre between Downtown, Little India and Kampong Glam. This concentration can be explained through the combination of the pre-established European and Chinese economy moving towards the newly established Indian local centre, and Kampong Glam, the area of the Sultan of Johore and residences of wealthy Arab merchants. Therefore, a city centre begins to spatially emerge and organize itself around areas of high to and through movement (Hillier, 2009). Through the combination of historical records and spatial observation, the Indian community and enclave has joined Singapore's social economy. However, the Malay community remains confined to their isolated local spatial boundaries.

4.3 Reintegration (1945 - 1989)

The post-war period (table.8) was a turbulent period of rebuilding and establishing a local government for Singapore. This also meant the need to establish a unified political stance, which was heavily influenced by ethnic politics. Urban infrastructure was also crippled during the war, further exacerbating existing issues of urban slums and housing issues. The elected government decided to use this opportunity of urban rebuilding to address the issue of ethnic division (table.9&10). This division was particularly disruptive to a cohesive social fabric as it kept different ethnicities in separated social groups, even isolating the Malay community. This cycle of urban deprivation led to the communal riots of the Malays against the Chinese (table.9). The government addressed this through educational and residential restructuring. Spatial segregation of ethnicities was addressed through the dispersal and relocation of urban slums and residential areas of ethnic enclaves (table.10).

Period	1945 - 1955: Post-War Period			
Society Overview)	Political awakening post war, strive for independence and ethnic reintegration.			
Year	1945	1946	1948 - 1953	1953 - 1954
Event	Japanese Surrender	Dissolving the Straits Settlement	State Elections	The Fajar Trial
Politics	The Japanese officially surrendered.	Singapore became a separate crown colony.	Only British subjects had the right to vote.	First sedition trail involving Socialist Club.
Ethno-political Outcomes	British loses favor of local population due to war.	Singapore prepared for self governance.	Local government began to form under British rule.	Socialist influence grew in Singapore.
Urban Development	Extensive damage to local infrastructure.	Post war rebuilding	Post war rebuilding	Post war rebuilding
Chinatown: Chinese (Divided by province and dialect); Indian traders	Overcrowding and urban slums were still an issue.			
Geylang: Malays; Orang Laut; Chinese traders			Well off Chinese moved out while more Malays moved in.	
Kampong Glam: Muslim community and streets organized by trade	Establishment of communal living for Indonesian and Malay Muslim immigrants from the same hometowns. They functioned as residences and also community clubs/activity centers.			
Little India: Indians; Chinese laborers; Javanese immigrants	Wealthier settlers returned to India but young Indian assistants took over the businesses.			
Downtown: Old civic quarters.	Downtown was the most damaged, post war rebuilding.			

Table 8: Historic Timeline, Post-War Period (1945 - 1955)

Period	1955 - 1971: Self governance				
Society Overview)	Masterplan and policies beginning to undo the spatial divides of ethnic segregation - relocation				
Year	1955 - 1959	1959 - 1963	1960	1963 - 1965	1965 - 1971
Event	Partial internal self-government / social unrest	Full internal self-government	Housing Development Board	Merger and Seperation with Malaya	First Independent Masterplan
Politics	Left leaning government was formed. Communist riots broke out.	The PAP won by appealing to the left leaning Chinese-speaking majority.	The HDB was set up to solve the 1960s housing crisis.	Problematic due to political rivalry and racial tension.	The first independent 50 year plan was formulated.
Ethno-political Outcomes	Riots led by pro-communist Chinese students and unionists.	Pro-communists members led to businesses leaving the country.	Singapore was filled with slums in poorly managed ethnic enclaves.	Outbreak of racial riots between Chinese and Malays in 1964.	Addressed population growth and socio-economic changes.
Urban Development	Chinese schools converted to English Education.	Industrial estates and New Towns proposed.	Self contained New Towns planned with mixed use hubs.	Seperation of borders	High-density developments built and existing districts connected.
Chinatown: Chinese (Divided by province and dialect); Indian traders	Overcrowding and urban slums were still an issue.		Urban renewal schemes resettled residents in HDB estates.		People's Park Centre mixed-use complex built.
Geylang: Malays; Orang Laut; Chinese traders	Well off Chinese moved out while more Malays moved in, increasing the Malay population.			Communal riots between the Malays and Chinese.	Three blocks of social housing were constructed.
Kampong Glam: Muslim community and streets organized by trade	Establishment of communal living for Indonesian and Malay Muslim immigrants from the same hometowns. They functioned as residences and also community clubs/activity centers.				Dispersal of ethnic villages and relocation to social housing.
Little India: Indians; Chinese laborers; Javanese immigrants			Many Indians moved out, choosing to stay in public housing or private estates.		
Downtown: Old civic quarters.				First national day parade was held.	The Civilian War Memorial built in memory of the massacres.

Table 9: Historic Timeline, Self-Governance (1955 - 1971)

Period	1971 - 1989: New Towns: Ethnic Regrouping	
Society Overview)	Redistribution of ethnic clustering throughout the country.	
Year	1970s - 1980s	1989
Event	Development of New Towns	Ethnic Integration Policy
Politics	Housing efforts intensified across Singapore.	Quota on ethnic residential mixing to enable even distribution.
Ethno-political Outcomes	Dispersal of residents in ethnic enclaves and slums.	To prevent ethnic clustering in residential estates.
Urban Development	Central areas were vacated and residents were resettled to the 21 New Towns.	Engineered multi-cultralism in residential spaces, buildings unchanged.
Chinatown: Chinese (Divided by province and dialect); Indian traders	Shophouses were upgraded and street hawkers were relocated to indoor markets.	Gazetted for conservation.
Geylang: Malays; Orang Laut; Chinese traders	Developed into flats, industrial estates, and commercial shopping areas.	Malay Village was set aside to preserve a replica of a Malay kampong
Kampong Glam: Muslim community and streets organized by trade		Gazetted for conservation as historic architecture
Little India: Indians; Chinese laborers; Javanese immigrants	Slums were cleared out	Now an Indian commercial center, and gazetted for conservation.
Downtown: Old civic quarters.	The Government Office building was converted into the Asian Civilization Museum	

Table 10: Historic Timeline, New Towns: Ethnic Regrouping (1971 - 1989)

Ethnic/Social Events
Urban Planning/Residential Events
Trade/Industry Events
Civic/Governance Events

4.3.1 Segment Analysis

The post-war period saw drastic urban change under the independent government. Singapore's historic centre and its surrounding enclaves became significantly denser (fig.14-19). The Downtown area became much more integrated on a local to global scale. Interestingly, its centre expands north towards Geylang which was previously underdeveloped. The largest change can be seen in Geylang - which has seen a rapid expansion and densification of urban infrastructure. This can be partially attributed to the local migration of the Chinese community, where they set up a Commercial District along the Geylang high street. Evidently, this led to a strong local, regional, and global structure (fig.14-19) with highly integrated and choice roads into Singapore's historic centre. Meanwhile, local integration and choice structure (fig. 14&15) has become increasingly fragmented in the other historic enclaves and Downtown centre, but regional and global connections remain strong. This analysis shows that the spatial logic of central Singapore has evolved with the densification of roads. By the 1980s, most residential areas and all urban slums were cleared out of Singapore's ethnic enclaves. Their respective commercial or cultural centres were also gazetted for conservation and are used for cultural and commercial purposes till today. The Ethnic Integration Policy was also applied to all social housing, which had quotas imposed on the percentages of residents who can relocate into these flats, categorized by ethnicity. While ethnicity remains a large part of Singapore's social politics, the approach was reversed from segregation into engineered reintegration.

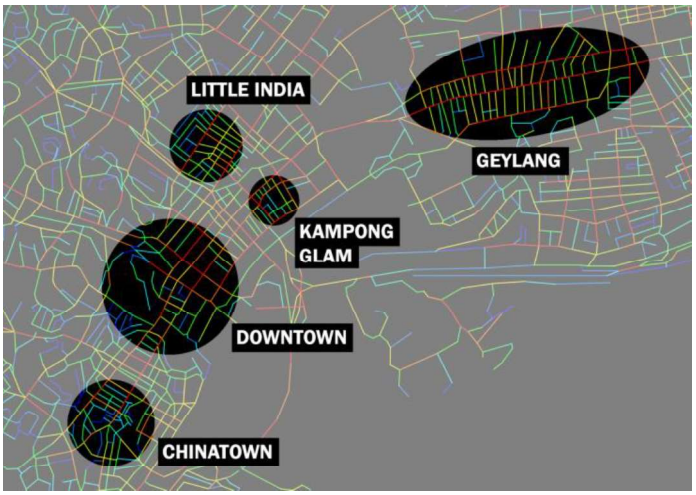


Figure 14: 1987 NAIN 400

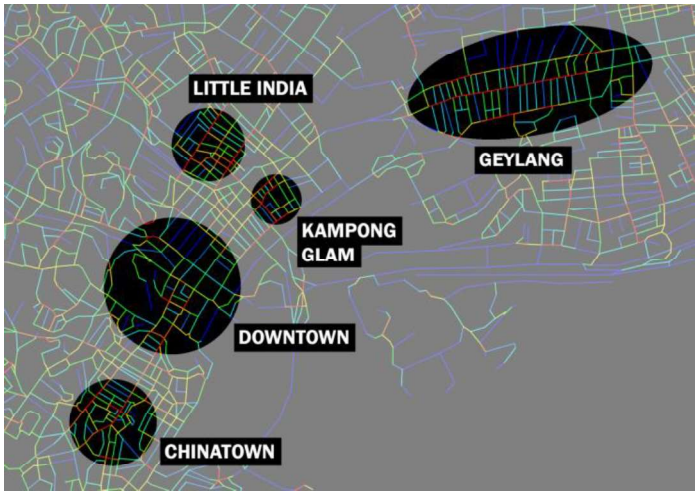


Figure 15: 1987 NACH 400

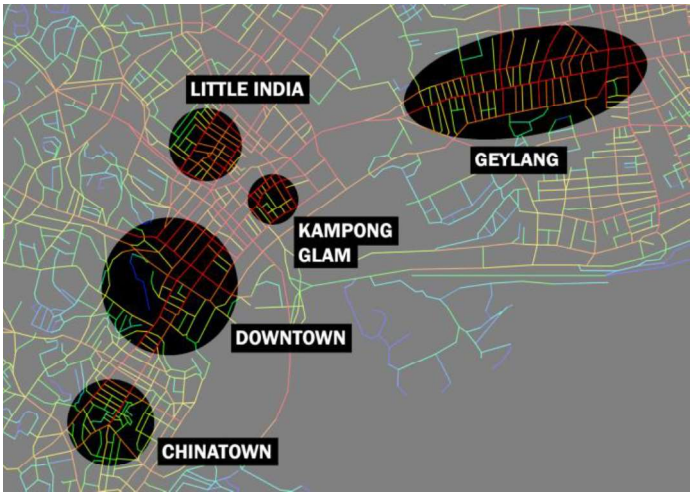


Figure 16: 1987 NAIN 2000

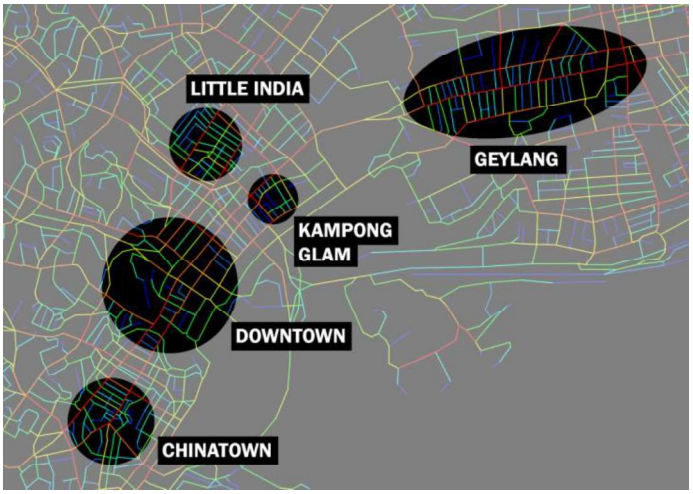


Figure 17: 1987 NACH 2000

Figure 18: 1987 NAIN n

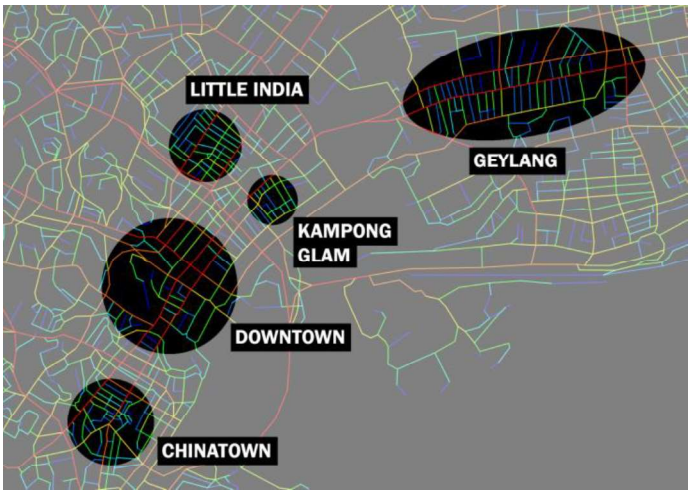


Figure 19: 1987 NACH n

4.4 Present Day (2021)

Present day Singapore operates much like the social logic of 1987. Not much has changed beyond the further development of New Towns, and the full implementation of the 1989 EIP (table.11). With recent efforts focused on pedestrianization (URA, 1991; Ho, 2020), how have the spatial identities of ethnic enclaves evolved since then?

Enclave	Year	NAIN n (Mean)		NACH n (Mean)		NAIN 2000 (Mean)		NACH 2000 (Mean)		NAIN 400 (Mean)		NACH 400 (Mean)	
		Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change
Downtown (Control)	1846	0.86364		1.020774		1.174381		1.044038		1.44977		0.775870192	
	1914	0.871197	1%	0.994475	-3%	1.164632	-1%	1.029135	-1%	1.39983	-3%	0.907490003	17%
	1987	1.003439	15%	1.011814	2%	1.149559	-1%	1.03119	0%	1.38088	-1%	0.879918663	-3%
	2021	0.974726	-3%	0.922994	-9%	1.125915	-2%	0.972086	-6%	1.1981	-13%	0.95893673	9%
Chinatown	1846	0.771767		0.883277		1.120294		0.950677		1.44771		0.810481338	
	1914	0.810318	5%	0.928775	5%	1.242107	11%	1.021854	7%	1.50541	4%	1.000021907	23%
	1987	0.859444	6%	0.883949	-5%	1.04537	-16%	0.96301	-6%	1.26714	-16%	0.964412026	-4%
	2021	0.889034	3%	0.86575	-2%	1.005753	-4%	0.939361	-2%	1.16212	-8%	0.964365817	0%
Geylang	1846	0.832272		1.151365		1.419685		0.851879		0.98073		0	
	1914	0.813544	-2%	0.911026	-21%	1.458097	3%	1.052217	24%	1.25496	28%	0.047224593	5%
	1987	0.936073	15%	0.979564	8%	1.251624	-14%	1.059163	1%	1.61551	29%	0.933776684	1877%
	2021	0.8902	-5%	0.897064	-8%	1.171901	-6%	0.978864	-8%	1.25966	-22%	0.965850779	3%
Kampong Glam	1846	0.867174		0.894848		1.252765		0.966074		1.50768		0.695016132	
	1914	0.871278	0%	0.927376	4%	1.356784	8%	1.035544	7%	1.51668	1%	1.022731137	47%
	1987	1.041882	20%	0.985055	6%	1.344477	-1%	1.051221	2%	1.52117	0%	0.97902416	-4%
	2021	1.01097	-3%	0.960805	-2%	1.270779	-5%	1.022815	-3%	1.45854	-4%	1.036070528	6%
Little India	1846	0.778201		0.829041		1.047804		0.741496		1.35886		0.335029808	
	1914	0.823755	6%	0.871059	5%	1.147579	10%	0.965615	30%	1.30039	-4%	0.909285507	171%
	1987	0.979236	19%	0.957775	10%	1.27374	11%	1.04967	9%	1.45729	12%	1.02217263	12%
	2021	0.938873	-4%	0.893266	-7%	1.234654	-3%	0.985594	-6%	1.35026	-7%	1.011880789	-1%

Table 11: Changes in accessibility (integration) and movement (choice) values over time

4.4.1 Segment Analysis

There is observable local change in Little India, Kampong Glam and Downtown, where they seem to have slightly more prominent clustering of local centres, while Chinatown remains locally fragmented (fig.20). Geylang retains its strong local to global structure (fig.20-25) and when compared to the land use map, Geylang also stands out as being the only predominantly residential district compared to the other historic enclaves. This explains the strong local integration and choice in Geylang as it possesses a strong foreground network on a local to global scale indicating high levels of intelligibility, while supporting a background network of residential buildings (Hillier, 2009; Hillier & Hanson 1984).

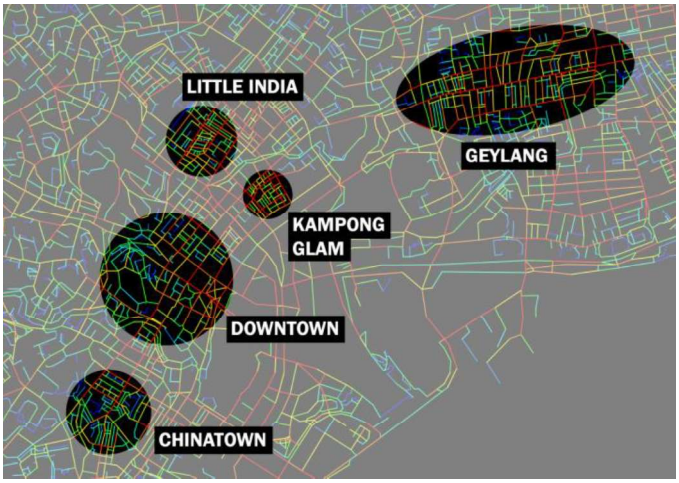


Figure 20: 2021 NAIN 40

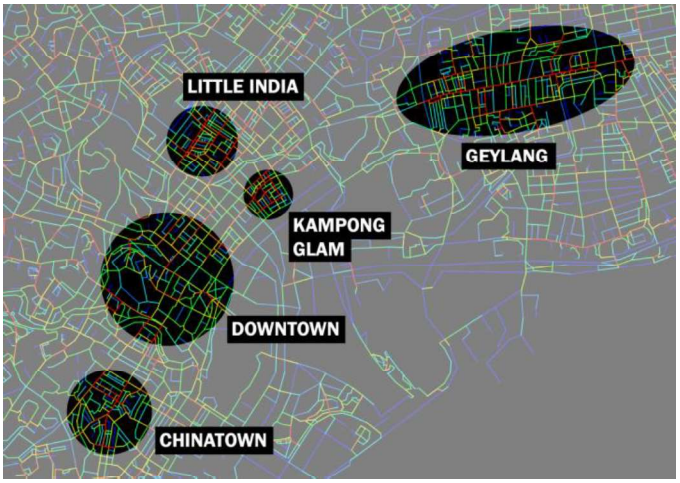


Figure 21: 2021 NACH 400

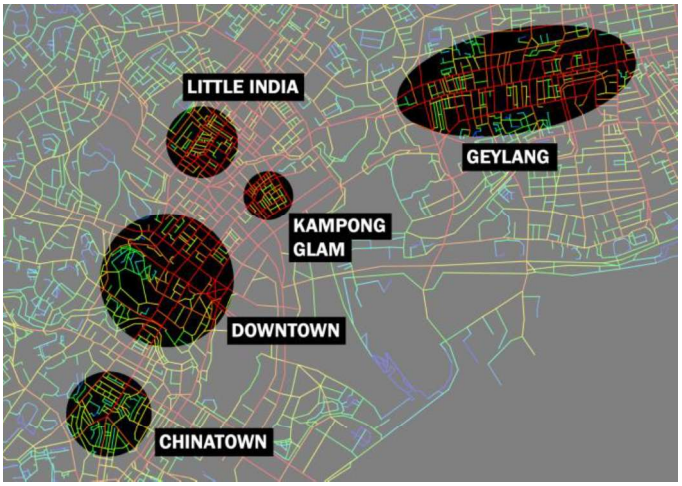


Figure 22: 2021 NAIN 2000

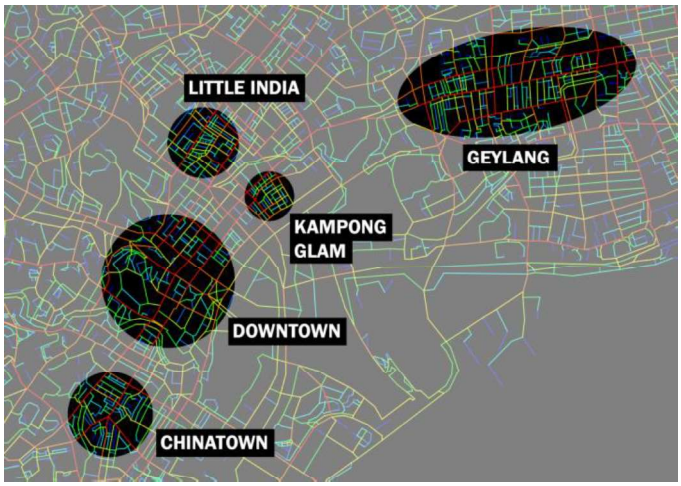


Figure 23: 2021 NAIN 2000

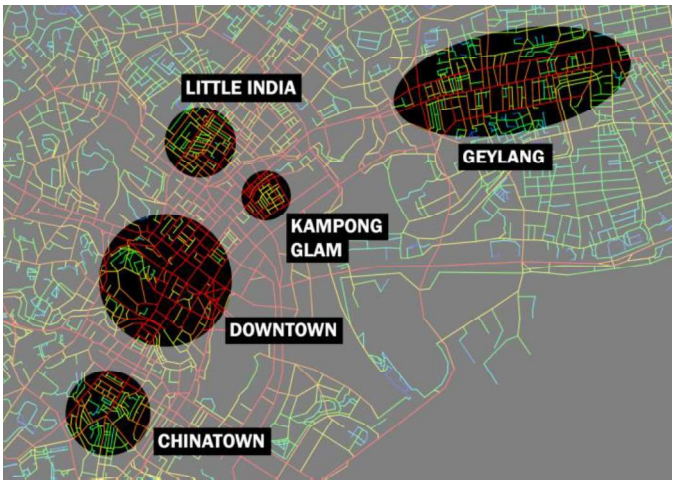


Figure 24: 2021 NAIN

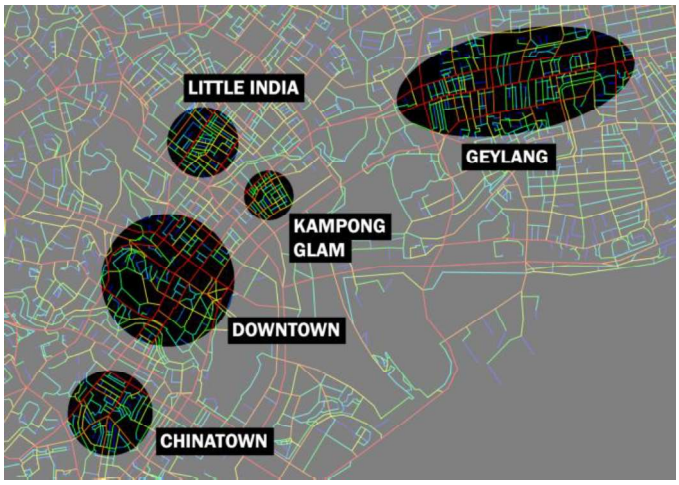


Figure 25: 2021 NACH n

4.4.2 Land Use Observations

The recent land use plan (fig.26) indicates that every ethnic historical quarter except the Geylang area has been converted into high density commercial hubs, with majority of the land uses allocated for businesses and shops. The lack of residential areas shows that moves to clear out urban slums have been successful. However, has the removal of residential areas affected the cultural identity of these enclaves?

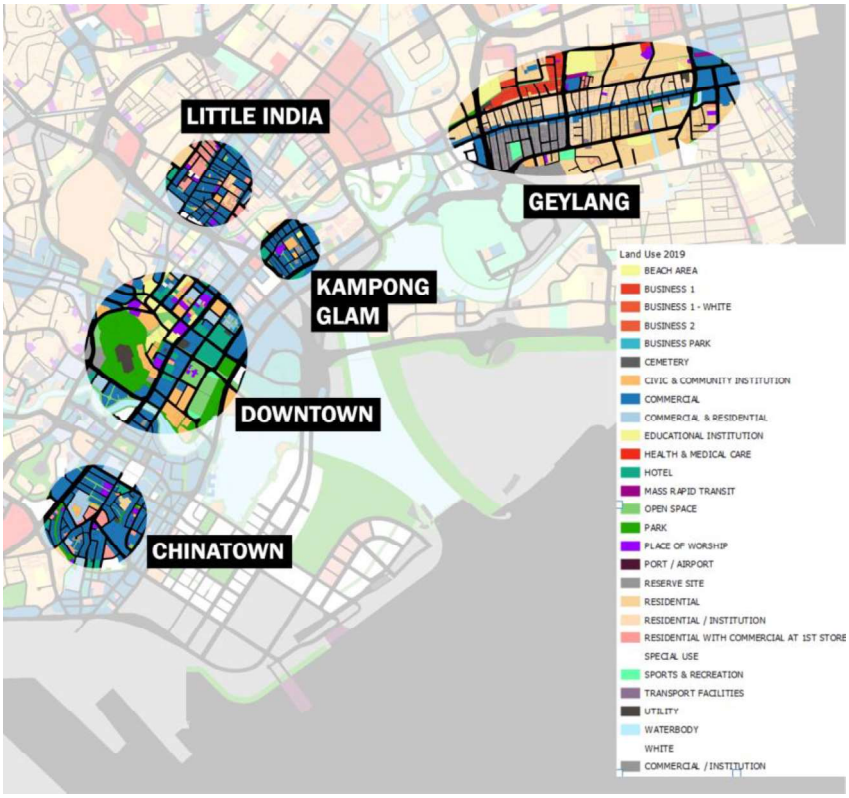


Figure 26: 2019 Land Use Plan (URA, 2021)

4.4.3 Segment Value Comparison

Table 10 compares the integration and choice values of enclaves over time, indicative of changes in spatial logic. The Downtown control area shows an upward trend of global integration over time, up till 1989. Regional integration and choice mainly fluctuate with little change, while local integration is constantly decreasing - indicating the prioritization of the global network. However, there is a large increase in local choice between 1989 and 2021, while global choice and integration decreases. This aligns with the move to pedestrianize this district, making it more accessible on a local scale. Meanwhile, Chinatown is becoming increasingly integrated locally while regional and local integration and choice routes are being left out. Geylang saw a rapid improvement to its global and local networks in 1987 during the infrastructure boom but is faced with a rapid decline in local integration in 2021. This trend of growth up till 1987 and then a decline in recent years is indicative of increasing isolation of these ethnic enclaves. If they are to be part of Singapore's future multicultural spatial logic and identity, this factor needs to be addressed. Additionally, Geylang, Kampong Glam and Little India maintain higher levels of local integration and choice values compared to Chinatown and Downtown till this day, indicating higher local correspondence.

Year	Enclave	NAIN n (Mean)		NACH n (Mean)		NAIN 2000 (Mean)		NACH 2000 (Mean)		NAIN 400 (Mean)		NACH 400 (Mean)	
		Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change
1846	Downtown (Control)	0.863640259	Control	1.020774434	Control	1.174380815	Control	1.044038397	Control	1.449769936	Control	0.775870192	Control
	Chinatown	0.771767352	-11%	0.883276942	-13%	1.120294276	-5%	0.950677382	-9%	1.447713981	0%	0.810481338	4%
	Geylang	0.832271629	-4%	1.151364796	13%	1.419684666	21%	0.851878874	-18%	0.980729272	-32%	0	-100%
	Kampong Glam	0.867173664	0%	0.8948479	-12%	1.252765474	7%	0.966073867	-7%	1.507675203	4%	0.695016132	-10%
	Little India	0.778201125	-10%	0.829040753	-19%	1.047803703	-11%	0.741496386	-29%	1.358861956	-6%	0.335029808	-57%
1914	Downtown (Control)	0.871196783	Control	0.994475028	Control	1.164631709	Control	1.029134762	Control	1.399829365	Control	0.907490003	Control
	Chinatown	0.810317562	-7%	0.928774684	-7%	1.242107157	7%	1.021853754	-1%	1.505408427	8%	1.000021907	10%
	Geylang	0.813543692	-7%	0.91102578	-8%	1.458096583	25%	1.052217269	2%	1.254962825	-10%	0.047224593	-95%
	Kampong Glam	0.871277956	0%	0.927376056	-7%	1.356783648	16%	1.035544405	1%	1.516684912	8%	1.022731137	13%
	Little India	0.823755285	-5%	0.871059069	-12%	1.147578826	-1%	0.965614751	-6%	1.30039277	-7%	0.909285507	0%
1987	Downtown (Control)	1.003439322	Control	1.011813561	Control	1.149559077	Control	1.031190481	Control	1.380879368	Control	0.879918663	Control
	Chinatown	0.859444273	-14%	0.883948592	-13%	1.045370256	-9%	0.963009927	-7%	1.26713822	-8%	0.964412026	10%
	Geylang	0.936072743	-7%	0.979563999	-3%	1.251624361	9%	1.059162816	3%	1.61551149	17%	0.933776684	6%
	Kampong Glam	1.041882476	4%	0.985055082	-3%	1.344477433	17%	1.051220804	2%	1.521166302	10%	0.97902416	11%
	Little India	0.979235504	-2%	0.957774742	-5%	1.273739509	11%	1.04966962	2%	1.457294489	6%	1.02217263	16%
2021	Downtown (Control)	0.974726193	Control	0.922993938	Control	1.125915459	Control	0.972086469	Control	1.198096102	Control	0.95893673	Control
	Chinatown	0.889033592	-9%	0.865750342	-6%	1.005752688	-10%	0.939361452	-3%	1.16211914	-3%	0.964365817	1%
	Geylang	0.890200115	-9%	0.89706439	-3%	1.171900692	4%	0.978864004	1%	1.259664745	5%	0.965850779	1%
	Kampong Glam	1.010969578	4%	0.960805145	4%	1.270779282	12%	1.022815268	5%	1.458537662	22%	1.036070528	8%
	Little India	0.938872826	-4%	0.893266096	-3%	1.234654107	9%	0.985593669	1%	1.350256184	13%	1.011880789	6%

Table 12: Comparison of enclaves over time

Table 12 compares the average integration and choice values of ethnic enclaves against the Downtown core over time. Enclaves mostly remain less integrated than the Downtown core - with exceptions of Kampong Glam in recent years when it is merged into the main historic centre. This is not necessarily bad but indicates the spatial prominence of the Downtown area as Singapore's city centre. Meanwhile, most enclaves retain their prominence as regional centres with higher to and through movement values - this is except for Chinatown. Chinatown likewise proves to be less locally integrated than Downtown - with exceptions to the period of 1914 where there was strong local self-organisation based on dialect, trade, and triads. Meanwhile, every other enclave has significantly higher local integration values, while choice values in all enclaves including Chinatown remain consistently higher. However, there appears to be a decline in overall integration and choice of these enclaves in recent years. The integration levels of ethnic enclaves have been increasing on a regional and local scale. This has had an impact on other factors such as the mixing of multicultural social reproduction, and the individual identities of ethnic enclaves. To assess the preservation of Singapore's multicultural identity, their spatial morphology concerning spatial socio-ethnic aspects will be discussed in the following section.

Chapter 5: How has language and ethnicity shaped the spatial morphology of Singapore's historic centre today?

Community socialization of previously divided ethnic groups have been addressed either directly - through the ethnic integration policy, or indirectly - through language and education which re-engineers the logic of correspondence models in Singapore's built environment (Senior Minister Lee Kuan Yew, Straits Times,4 March 2001). In this case, Singapore's engineered multiculturalism brings us to a new stage of understanding its spatial heritage. As ethnic groups are no longer involuntarily bound to spatial boundaries, historic enclaves can be viewed instead, as spaces that instil commonplace diversity within the city. Commonplace diversity refers to cultural diversity being experienced as a part of everyday social life (Wessendorf, 2013). The following research questions explore these concepts.

How has language and ethnicity shaped the spatial morphology of Singapore's historic centre today? This will be examined through ethnically and culturally significant datasets to answer the following questions:

1. How successful has the Ethnic Integration Policy been in achieving a multi-ethnic mix in historic enclaves? (Census, Restaurants)
2. How well has ethnic enclaves preserved their cultural identities? (Worship, Language Signs)
3. What was the role of language - through historic educational institutions in spatially shaping co-presence in the city? (POI Schools vs correlating choice and integration)

5.1 The social engineering of multiracialism in ethnic enclaves

This section will be looking at how the goal of multiracialism was achieved through the intentional distribution of racial groups in residential estates through social housing policy. To supplement this, we will also be looking at measures of social reproduction documented through data on restaurant cuisine clustering to verify the spatial distribution of ethnic social groups.

5.1.1 Exploration of Ethnic Groups through Census Data

We begin by looking at the demographics of people still living in these enclaves (table.13). The only area which mostly corresponds to Singapore's overall ethnic mix (fig.27) would be Geylang - a mostly residential district made up of Housing Development Board flats (social housing). Therefore, it is organized by the Ethnic Integration Policy to achieve an even distribution of each ethnic group. However, the other enclaves and Downtown area are not entirely subjected to this policy due to many of the residential properties being privately owned (Ministry of Trade and Industry, 2019). Therefore, in Downtown the percentage of Chinese is significantly lower than average, while there are higher percentages of other ethnicities living there. In Chinatown, Little India and Kampong Glam, similar occurrences can be seen where there is a stronghold of their respectively associated ethnicities. While these figures are less drastic than the ethnic division of the past, they still maintain their identities as favoured locations of residence for their ethnic groups. What is interesting is that Kampong Glam has become significantly more favoured by residents of Indian ethnicity than Little India itself, although both enclaves share close spatial proximity.

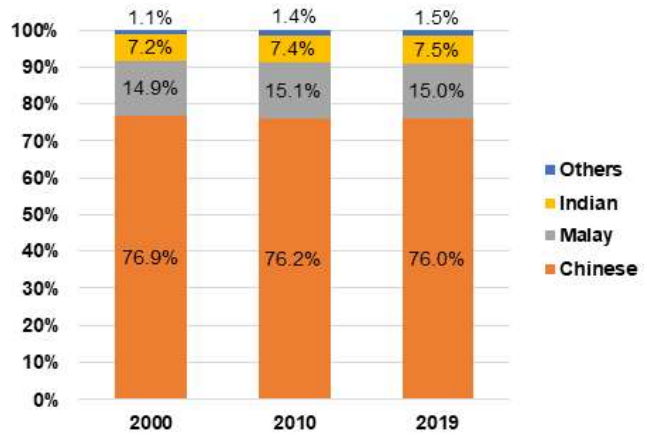


Figure 27: Racial proportions of Singaporeans (gov.sg, 2021)

Singapore Population Census Data 2015										
Area	Subzone	Total	Chinese	Malays	Indians	Others	Percentage			
							Chinese	Malays	Indians	Others
Downtown	Downtown	380	220	-	40	110	58%	0%	11%	29%
	Bras Basah	10	-	-	-	-				
	Dhoby Ghaut	210	150	-	10	50				
	Fort Canning	160	70	-	30	60				
Chinatown	Chinatown	14020	12050	640	920	410	86%	5%	7%	3%
	China Square	1590	1540	10	20	30				
	Chinatown	11880	10060	620	870	330				
	People's Park	390	360	-	10	10				
	Cecil	160	90	10	20	40				
Little India	Little India	3850	2810	30	970	40	73%	1%	25%	1%
Kampong Glam	Kampong Glam	170	60	30	70	20	35%	18%	41%	12%
Geylang	Geylang	75090	58460	8170	5750	2710	78%	11%	8%	4%
	Aljunied	41710	34510	3030	2680	1490				
	Geylang East	33,380	23,950	5,140	3,070	1,220				
Singapore Ethnic Composition 2015							75%	13%	9%	3%

Table 13: Census of Ethnic Percentage Per Enclave (data.gov.sg, 2015)

5.1.2 Social Reproduction in Restaurants and Ethnic Cuisine

The social phenomena of achieving multi-ethnic mixing can be studied in more detail through the mapping of restaurants of various cuisines associated to these ethnic groups. As mentioned in the literature review, another important aspect of spatial logic is the social reproduction reflecting daily life and spatial interaction (Lefebvre, 1974). Therefore, restaurants reflect these practices and cuisines would be indicative of the spatial reproduction of different ethnic groups (fig.28-31). Chinese and Western cuisines can be seen to permeate three main areas. Identified through K-means clustering, the centroids (indicated by the white cross) can be identified in Chinatown, Downtown and Geylang. This reflects the global connection that Chinese and Western culture have with the spatial logic of Singapore. But what is also interesting is their lack of presence in Little India and Kampong Glam. Meanwhile, these two enclaves retain a strong relationship with their respective cuisines, containing most Indian and Malay restaurants in their representative historic enclaves. However, again contrary to the stark ethnic division recorded in the past, there still is a good amount of mixing when it

comes to different cuisines being present in other enclaves, although historic enclaves still retain a stronghold (table.14).

Area	Restaurant Cuisines					Percentage			
	Chinese	Malay	Indian	Western	Total	Chinese	Malay	Indian	Western
Downtown	15	0	6	39	60	25%	0%	10%	65%
Chinatown	56	0	3	43	102	55%	0%	3%	42%
Little India	4	3	35	2	44	9%	7%	80%	5%
Kampong Glam	3	9	2	8	22	14%	41%	9%	36%
Geylang	13	1	0	10	24	54%	4%	0%	42%

Table 14: Chart of Restaurant Cuisines Per Enclave

Figure 28: Map of Western Cuisine

Figure 29: Map of Indian Cuisine

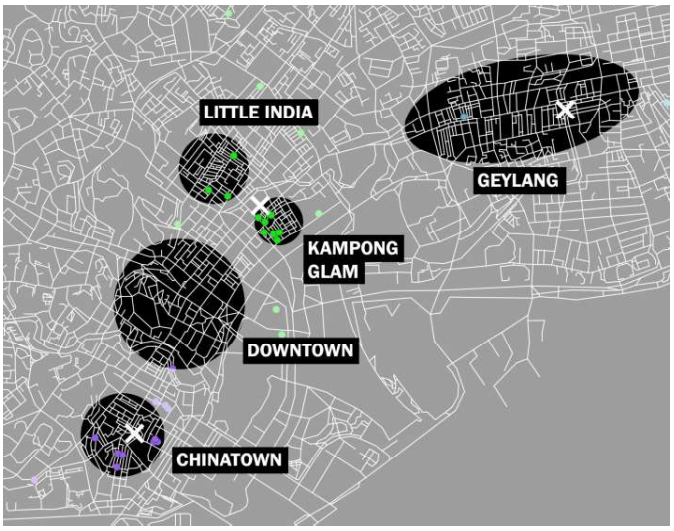


Figure 30: Map of Malay Cuisine

Figure 31: Map of Chinese Cuisine

**Colours are indicative of different identified clusters by the k-means methodology*

5.2 The Presence of Cultural Identity within Ethnic Enclaves

5.2.1 Language of Signs

To examine how well cultural identity has been preserved in these enclaves, street and retail signs have been identified in these spaces and catalogued based on languages observed (refer to 3.4.4 under methodology) (table.15; figure. 32). English - except for the Geylang Serai Market, remains the dominant language in every area of Singapore. However, with exception of the Downtown control study, a dominant secondary language can be observed in the respective enclaves. These corresponded with the ethnic identities of these locations. Geylang (Serai) firstly, is an exceptional case with Malay being the primary language observed in the area. Meanwhile, Chinatown and Geylang (Lorong), which is the dominant Chinese Main Street have been observed to have a dominant secondary language of Chinese. Little India likewise has a dominant secondary language of Tamil, while in Kampong Glam, observed languages ranged from Arabic to Turkish among several other languages associated with Middle Eastern Islamic regions. This information corresponds with the recorded historical cultural identities of these areas, referring to the ethnic enclave overview (table.3).

Area	Total	English	Chinese	Malay	Tamil	Others	Mixed	Percentage					
								English	Chinese	Malay	Tamil	Others	Mixed
Downtown	70	42	7	0	0	7	14	60%	10%	0%	0%	10%	20%
Chinatown	34	10	8	0	0	0	16	29%	24%	0%	0%	0%	47%
Little India	168	67	11	1	44	0	45	40%	7%	1%	26%	0%	27%
Kampong Glam	72	31	4	2	0	15	20	43%	6%	3%	0%	21%	28%
Geylang (Lorong)	283	112	83	3	5	3	77	40%	29%	1%	2%	1%	27%
Geylang (Serai)	90	20	2	50	0	0	18	22%	2%	56%	0%	0%	20%

Table 15: Identified Languages on Street Signs in Respective Enclaves

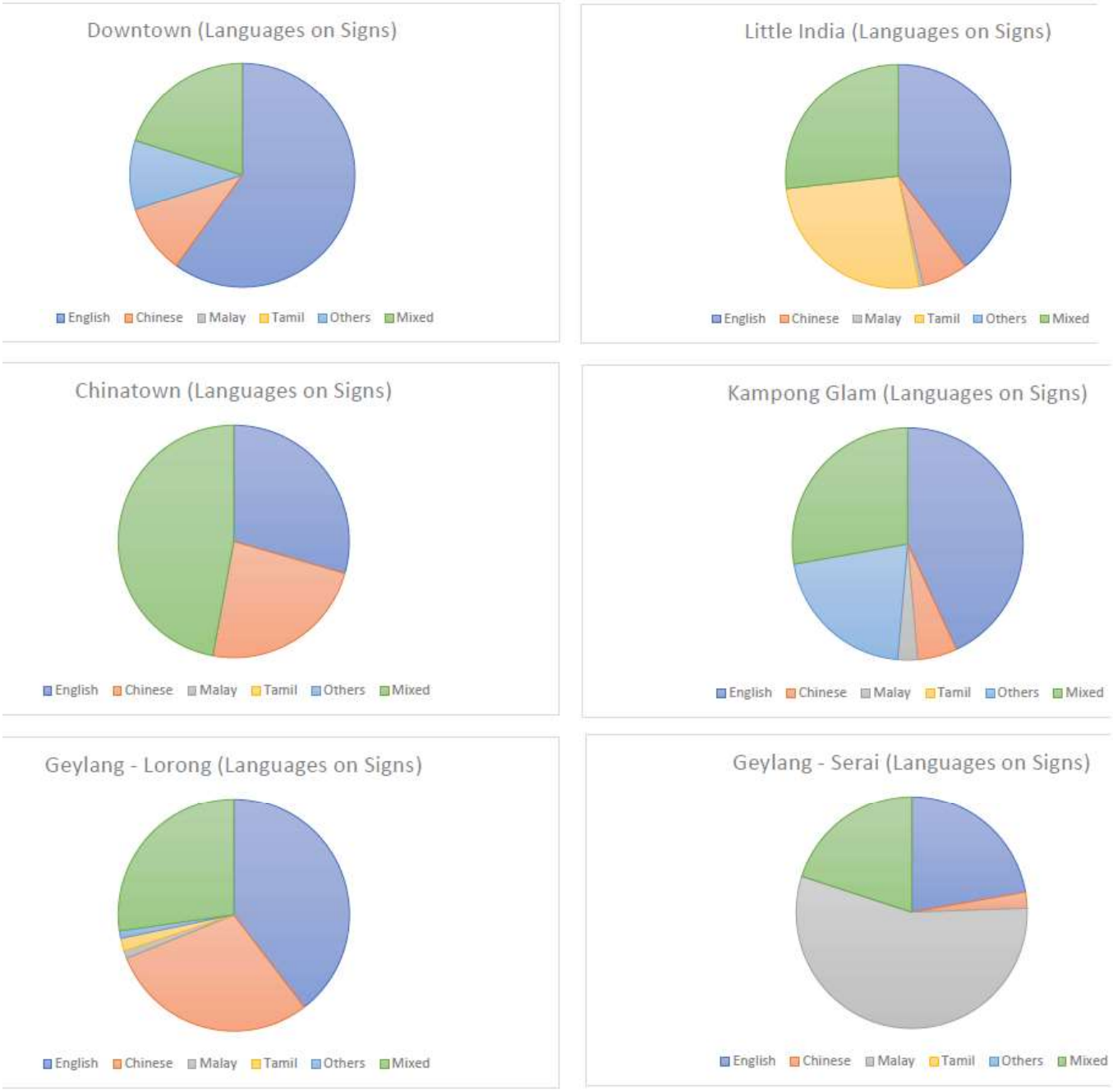


Figure 32: Overview of Identified Languages on Street Signs

5.2.2 Places of Worship

The secondary measure of cultural identities looks at places of worship in Singapore. Singapore is a multi-religious city, corresponding to the ethnic makeup. Buddhism and Taoism for the Chinese population, Islam for Malays, Hinduism for Indians, and other religions for minority ethnic groups. However, religion in Singapore no longer has significantly strong ties to ethnic groups, with Christianity being associated with multiple ethnicities, while 20% of the population is not religious (Fig.33). Nevertheless, places of worship are still worth looking into due to their strong historic ties with immigration and preserved spatial heritage. Places of worship in Downtown, Little India, Chinatown and Kampong Glam (fig. 34-38) can be seen to closely follow their historic ethnic settlements, with the percentage of places of worship representative of their dominant ethnic groups. The exception has been made for Geylang, representing a range of religious places of worship (fig.36). Perhaps this can also be attributed to the fact that Geylang is mostly a New Town subjected to the Ethnic Integration policy, with most of its historic kampongs and landmarks cleared out. Therefore, from these studies, ethnic enclaves - except for Geylang, have prevailed in preserving their historic cultural value through the prominence of dominant languages and places of worship observed in their respective areas.

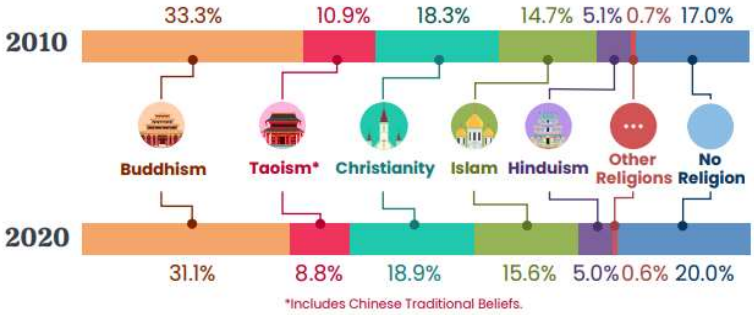
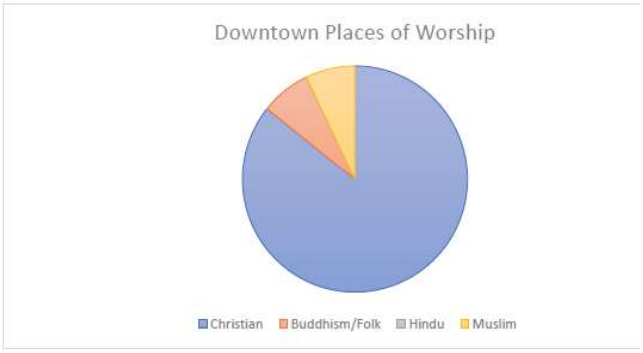
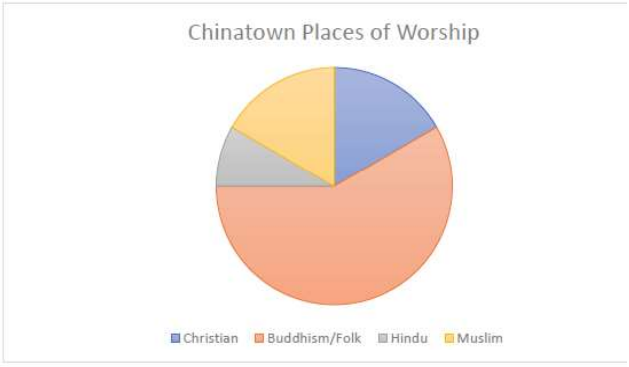


Figure 33: Census 2020 - percentage of religions in Singapore (Singstat, 2020)



	Total	Christian	Buddhism/Folk	Hindu	Muslim
Number	15	12	1	0	1
Percentage		80%	7%	0%	7%

Figure 34: Places of Worship in Downtown Singapore

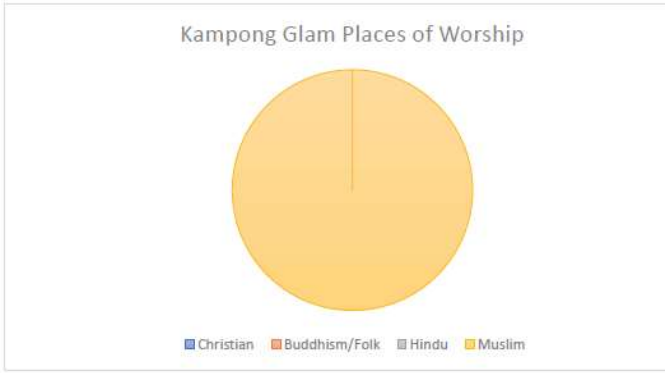


	Total	Christian	Buddhism/Folk	Hindu	Muslim
Number	12	2	7	1	2
Percentage		17%	58%	8%	17%

Figure 35: Places of Worship in Chinatown

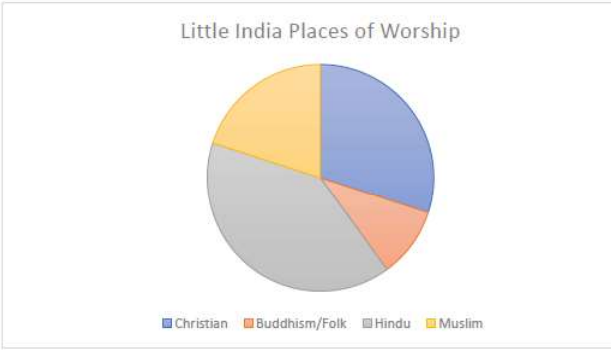
	Total	Christian	Buddhism/Folk	Hindu	Muslim
Number	13	4	4	1	4
Percentage		31%	31%	8%	31%

Figure 36: Places of Worship in Geylang



	Total	Christian	Buddhism/Folk	Hindu	Muslim
Number	4	0	0	0	4
Percentage		0%	0%	0%	100%

Figure 37: Places of Worship in Kampong Glam



	Total	Christian	Buddhism/Folk	Hindu	Muslim
Number	10	3	1	4	2
Percentage		30%	10%	40%	20%

Figure 38: Places of Worship in Little India

5.3 The Role of Language in Spatially Shaping Co-presence in the City

5.3.1 Historic schools and their language of instruction

How has the spatial logic of schools affected the urban morphology of Singapore's historic centre? Historic schools were identified for their languages taught and location (refer to section 3.4.4). Firstly, the number of Chinese and English schools were largely disproportionate to the number of Malay and Tamil schools (table.16). The spatial clustering of schools (centroids indicated by white crosses) likewise reflects the spatial disparity between Chinatown and Downtown from the rest of the ethnic enclaves (fig.39) where there were no identified clusters of schools within Little India, Kampong Glam and Geylang. This large disparity is worth looking into, especially for its role in structuring patterns of spatial co-presence within the city, and between different ethnic groups. Currently, the lack of accessible educational institutions in Little India, Kampong Glam and Geylang is indicative of the earlier mentioned division of the modern and rural economy. Chinatown and Downtown were places where the Chinese and Europeans benefited from being part of the modern economy based on non-correspondence models. This also coincides with the basic administration or manual labour majority of the Indian and Malay population were relegated to which did not prioritize higher levels of education (Goh, 2008; Lily Zubaidah, 2001).

	Language of Instruction				
	Total	English	Chinese	Malay	Tamil
Number	61	35	22	2	2
Percentage		57%	36%	3%	3%

Table 16: Language of Instruction in Historical Schools (Based off National Library Board historic school records)

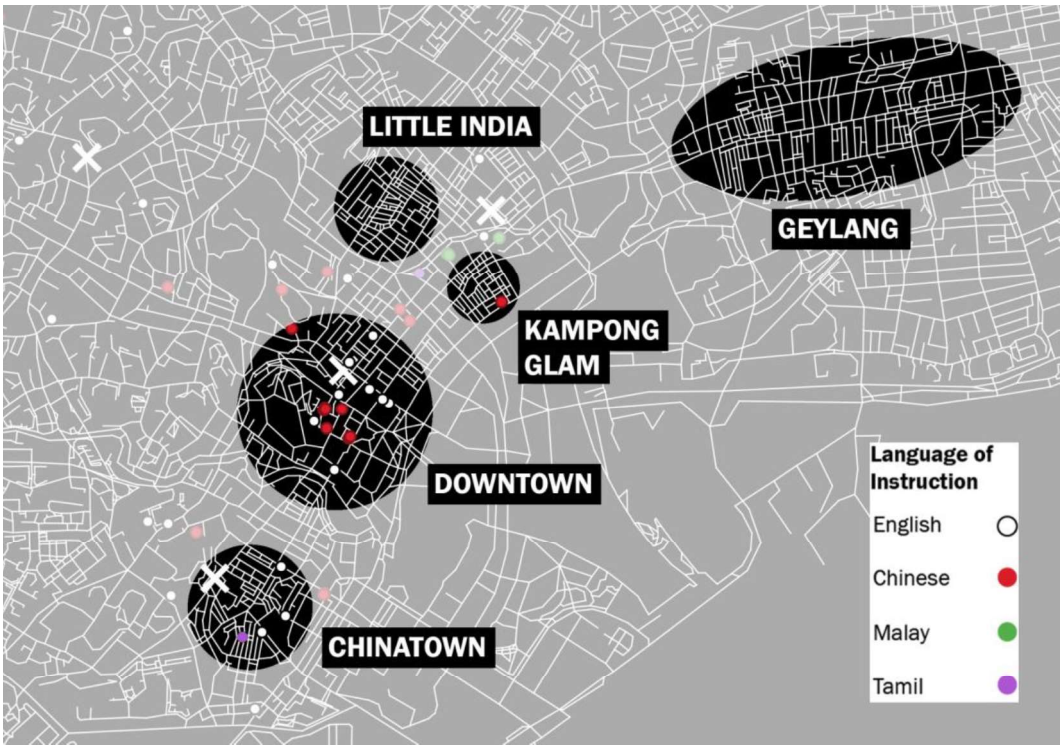
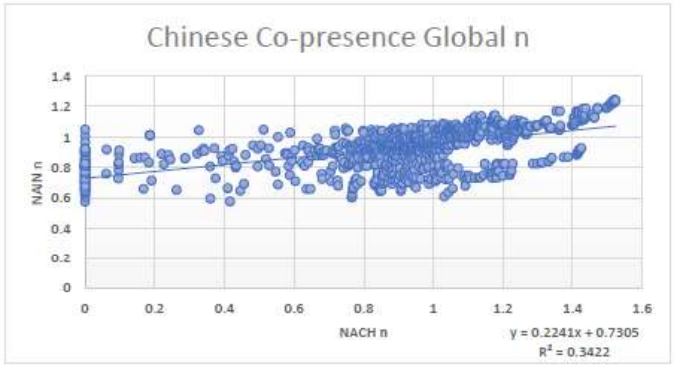
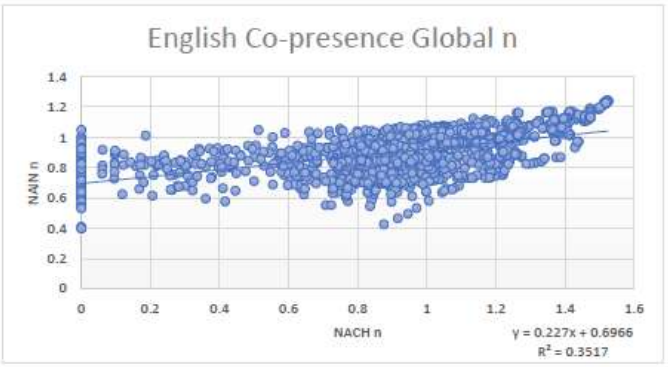


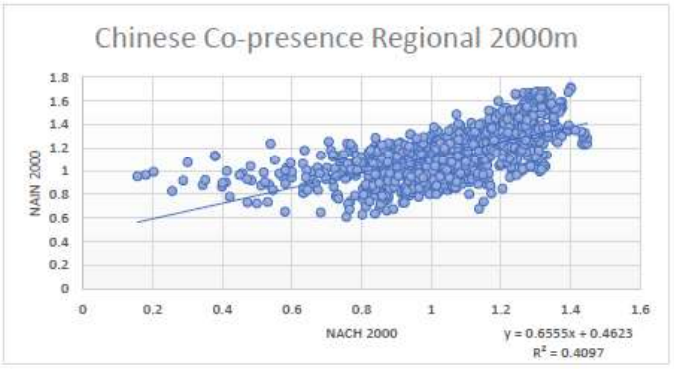
Figure 39: Map of historic schools, classified by language and plot on present 2021 map

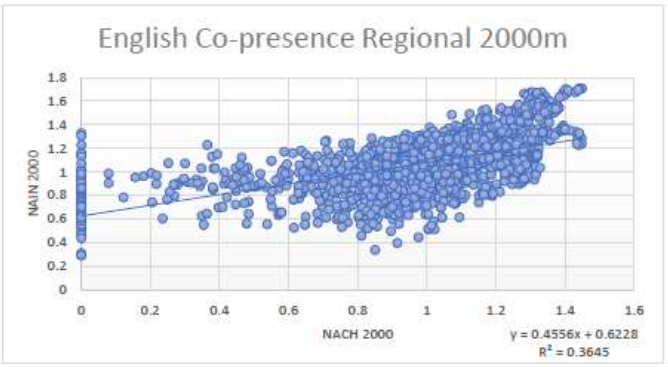
5.3.2 The role of historic schools in encouraging spatial co-presence

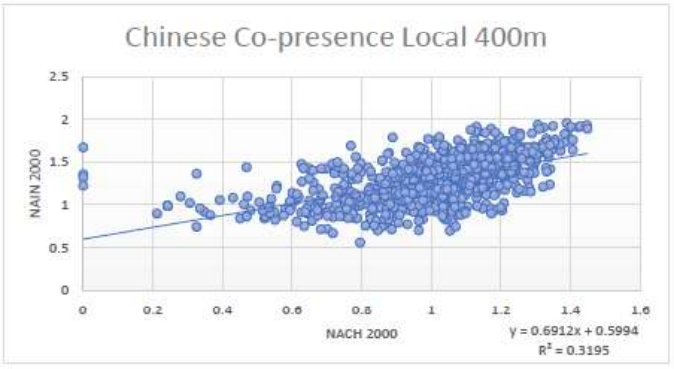
Spatial co-presence defines key points of encounter between the city's population, which can be modelled based on accessibility (Rokem & Vaughan, 2017). This is calculated through the cross-over between different flows of movement through the city, first proposed by Hillier through the correlation between the values of spatial integration and choice (Hillier et al., 1987). This creates an index on the degree of movement interface between inhabitants and visitors - or in the case of this analysis, between people from different ethnic origins and enclaves.











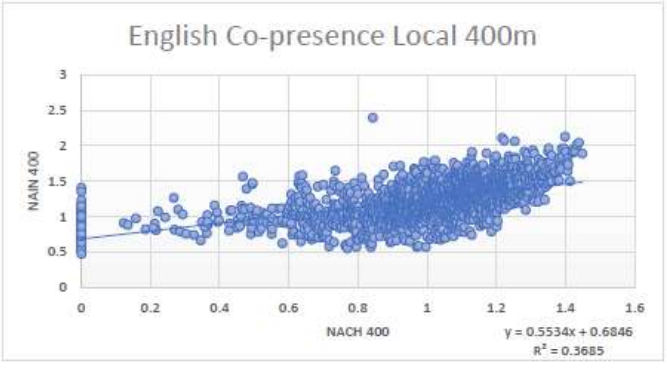
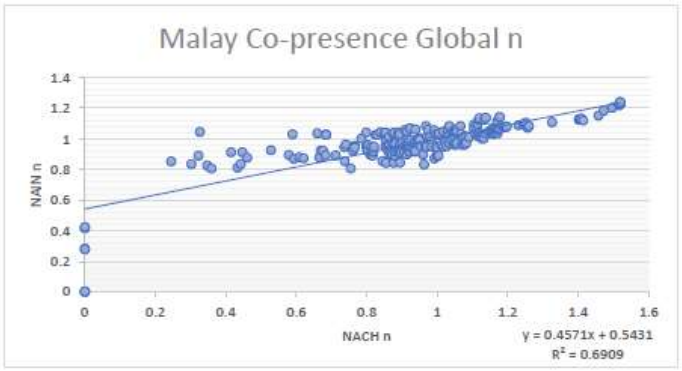
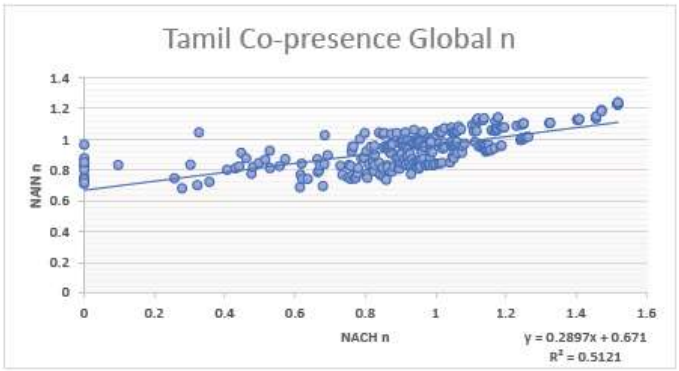
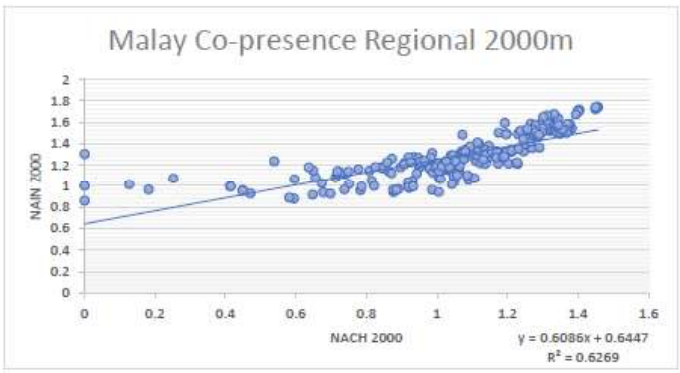


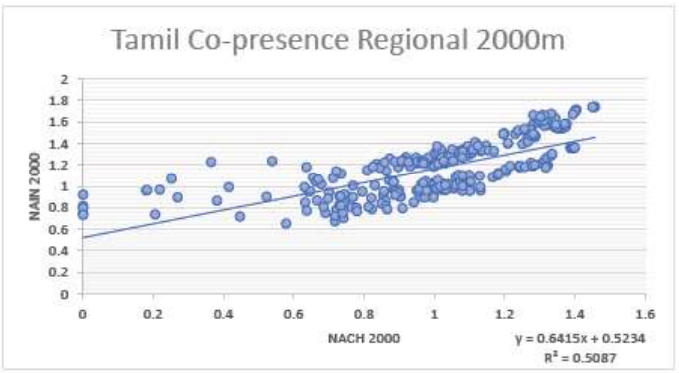
Figure 40: Roads 500m of Chinese Schools

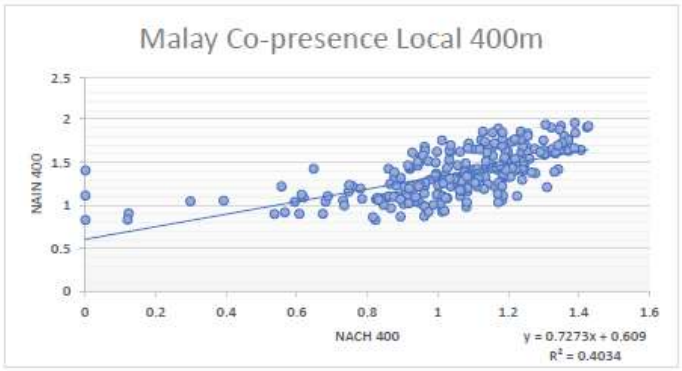
Figure 41: Roads 500m of English Schools











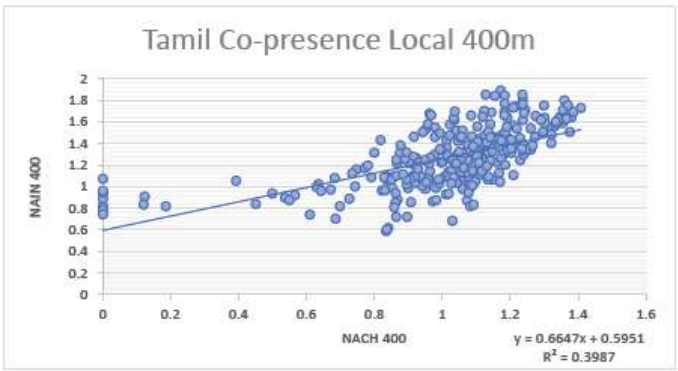
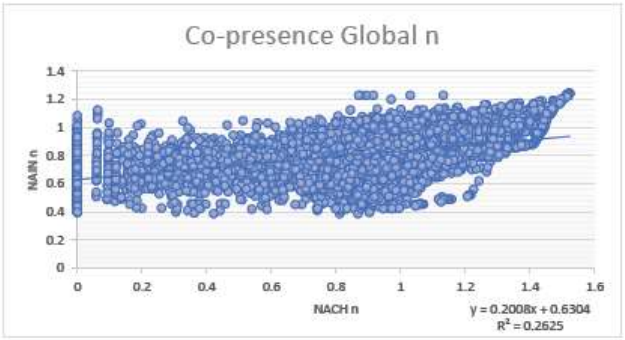
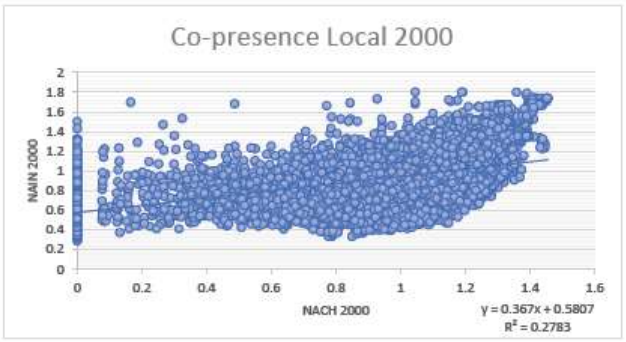


Figure 42: Roads 500m of Malay Schools

Figure 43: Roads 500m of Tamil Schools





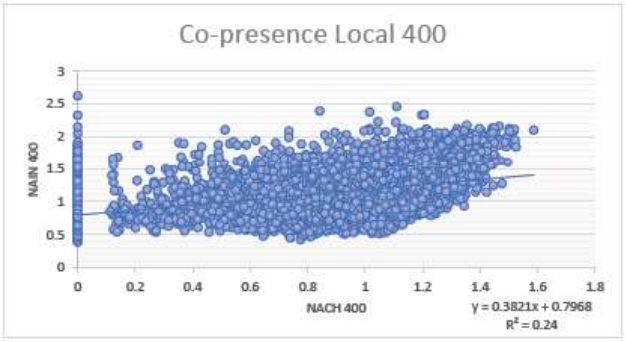


Figure 44: Average Road Co-presence

	R Squared Values		
Language of Instruction	Global n	Regional 2000m	Local 400m
Singapore Control	0.2624615	0.278338174	0.2400193
Chinese	0.3422223	0.403189143	0.3886468
English	0.3516924	0.364461503	0.3684671
Malay	0.6908906	0.626893299	0.4033974
Tamil	0.5121252	0.508688925	0.3986896

Table 17: Comparison of R Squared Values

In the above graphs charting the relationship between integration and choice generated by schools with different languages of instruction (fig. 40-44). The results are definitive that in street segments within 500m from historical schools, the R squared value (table.17) between choice and integration are significantly higher than average, especially in the cases of Malay and Tamil language schools. This shows that the cross-over between different flows of movement through areas near these schools evolved to be higher than normal through global, regional, and local scales. Another observation is that schools are generally located in better connected areas such as the Chinatown enclave, Downtown and Kampong Glam while Little India and Geylang did not house any historical schools. Therefore, these generated levels of co-presence only benefited areas which were already less isolated. This indicates that in segregated enclaves, there was a lesser probability of outsiders crossing into the neighbourhood.

Language of Instruction	Integration Values					
	Global n	%	Regional 2000m	%	Local 400m	%
Singapore Control	0.792416		0.903506804		1.124260006	
Chinese	0.939769	19%	1.132348168	25%	1.271079158	13%
English	0.901307	14%	1.062858341	18%	1.208873763	8%
Malay	0.988503	25%	1.285116207	42%	1.367311644	22%
Tamil	0.943104	19%	1.170824182	30%	1.267139266	13%

Language of Instruction	Choice Values					
	Global n	%	Regional 2000m	%	Local 400m	%
Singapore Control	0.806923		0.879570244		0.85704451	
Chinese	0.933741	16%	0.990979504	13%	0.951599887	11%
English	0.901707	12%	0.965933883	10%	0.947364735	11%
Malay	0.974427	21%	1.052274836	20%	1.042629781	22%
Tamil	0.939199	16%	1.00926146	15%	1.010951634	18%

Table 18: Comparison of Integration and Choice Values of Roads 500m from Schools.

Results also show higher integration and choice values along segments within 500m from historical schools (table.18). The placement of historic schools coincided with areas which developed into high choice and integration routes. Therefore, historic schools played a role in structuring patterns of co-presence in these areas. Schools were also not confined to ethnic enclaves, and therefore, served as catalysts that brought people who spoke different languages into common spaces. While schools in the past were divided by language and to some extent, ethnicity, they still played a role in shaping urban co-presence. The transition of all schools into a predominantly English medium today can be seen as an extension of this socio-spatial phenomenon which plays a large role in the multi-cultural mix of Singapore's schools today. Therefore, schools make up one of such urban spaces which shape the flow of movement, creating patterns of natural co-presence enabling social and cultural exchange (Hillier, 1996; Hillier and Vaughan, 2007).

Chapter 6: Singapore's Ethnic Conglomeration and its Impacts on Spatial Logic

In this section, we will summarize and discuss the findings of part 1 and 2 of Singapore's historical and present-day analysis.

Part 1: The urban plan of Singapore has seen a transformation in spatial logic from one of ethnic segregation to engineered multi-racial conglomeration. This multifaceted transformation saw the urban network and spatial morphology evolve alongside social policies such as education and housing to turn a pluralised framework into one that is homogeneous to a certain extent. It was evident in section 4.1 that between 1819-1867, ethnic communities assigned to their enclave saw controlled levels of urban mobility. We can also verify in our analysis the documentation in section 2.2 that Singapore operated on differential solidary (Hillier and Hanson, 1984). The Indian and Malay enclaves or kampongs were relegated to a rural economy with poor global scale connections; while the Chinese and particularly, the European communities benefitted from a non-correspondence model of global and regional mobility. In section 4.2, it was observed in the 1914 network analysis that while ethnic segregation persisted, changes in levels of mobility could be observed in certain enclaves. Communities which benefit the global economy were increasingly integrated into an expanding local centre between Downtown, Little India and Kampong Glam. This change was seen in the historic timeline in section 4.2.1 where the Indian community began to support regional trade, while providing for bullock cart materials and infrastructure. Resultingly, road infrastructure was built in the previously informal settlement of Little India, connecting it into the local centre. Likewise, densification of Kampong Glam could be seen between the 1914 network in 4.2 and the 1987 map in 4.3. This area has been increasingly integrated, becoming a part of the expanded Downtown global centre due to the settlement of high-ranking Malay officials and wealthy Arab merchants. In the 1987 map, the largest urban change could be seen in the Geylang area, with rapid expansion and densification. This was linked to the local migration of the Chinese community, from the timeline in section 4.4.1. This resulted in a Chinese run commercial centre and high street being established, while the original Malay communities migrated further east to Geylang Serai. It was also within this period that major housing restructures took place. Most residential areas and all urban slums were cleared out of Singapore's ethnic enclave, relocating displaced citizens in New Towns with imposed ethnic quotas (see section 2.4). Therefore, the spatial logic of enclaves would be drastically changed as their main purposed was no longer that of ethnic segregation, but rather, functioned as historic and commercial centres for ethnically based goods, services, and restaurants (section 4.4).

From this analysis, Singapore's centre can be said to be an intentionally structured town with powerful spatial logic. This has been linked through the historical timeline to ethnic-linguistic change affecting social organisation and the economy. This was evident through the explanation of Hillier and Hanson's (1984) Correspondence Theory. Singapore achieved pluralist organisation, effectively separating the urban space into separate forms of mechanical and organic solidarities (Durkheim, 1893) - termed 'differential solidarity' (Hillier & Hanson, 1984). This was achieved through language - and the availability of education, and by extension, job, and trade opportunities in various industries. Enclaves were designed for a rural economy based on mechanical solidarity and local correspondence. This spatial logic was likewise proven through studies on changes in local to global scale network values over the years, where Geylang, Kampong Glam and Little India still maintain higher levels of local choice and integration till this day.

Part 2: Expanding on the urban histories and networks explored in part 1, part 2 aims to answer how ethnicity and language has shaped the present spatial morphology of Singapore's historic centre. This looks at the success of ethnic integration and conglomeration, the preservation of cultural identities in historic enclaves, and the role of language in spatially shaping co-presence in the city (refer to chapter 5).

The Ethnic Integration policy only applied to state managed housing - meaning it was effective in the distribution of ethnicity in the Geylang area. However, other ethnic enclaves were primarily commercial districts with some private housing. Therefore, clustering of specific ethnicities could still be observed to some extent in these areas through census data (section 5.1.1) although there is a multiracial demographic in these areas. Furthermore, a study on cuisine types showed that while there is a distribution of different cuisines across all areas, enclaves still favour cuisines of their historic ethnic cultures (section 5.1.2). This was indicative of ethnic integration in these areas, although there was still a preference to reside in these historic enclaves by respective ethnic groups. Additionally, cuisine type shows to a certain extent, that there is still an ethnically driven cultural narrative present in the social reproduction of these spaces.

To further investigate the preservation of cultural identities, we looked to cataloguing places of worship and languages on signs seen in these enclaves (section 5.2.1, 5.2.2). Many historic places of worship have been preserved in their original locations. This corresponded to the religions of the respective ethnicities, and historic enclaves – except for Geylang, still retain a higher proportion of their unique religious places of worship. The outlier of Geylang can also be explained due to it being a partial New Town, with the later migration of the Chinese community, and the presence of social housing estates accommodating for strict multi-racial quotas. Therefore, new places of worship have populated the area, resulting in an even distribution different religious place of worship. Additionally, research shows that enclaves corresponded to the languages found on signs in those areas. Languages spatially corresponded to those spoken by the original communities of historic enclaves. This shows that languages and religious buildings found in these enclaves once again associated with their cultural heritage and identities. This proves that while the residential populations can be organized for multi-ethnic equality to some extent, the spatial logic and morphology of historic enclaves still preserve a strong sense of cultural identity.

Lastly, we ask the question of how language played a role in shaping spatial co-presence today. While once a divisive framework, educational institutions still played a large role in shaping patterns of co-presence and community interaction (section 2.3). On a micro-level, educational institutions linguistically segregated the population on many scales as previously investigated. However, the spatial patterns of schools could bring different ethnic communities together on a larger local-regional scale. English, Chinese, and Tamil schools could be seen to be dispersed throughout Singapore's city centre regardless of ethnic enclaves. Research found that regardless of language of instructions, it has been proven that historical schools have played a major role in encouraging spatial co-presence. Streets within 500m of schools have shown significantly higher choice and integration values compared to the average value of Singapore's urban network. Additionally, linear regression shows that the choice and integration values of streets were highly correspondent, indicating high levels of co-presence (section 5.3). Therefore, language and ethnicity are intrinsically related within the urban morphology of Singapore's historic centre. The spatial logic of schools played a part in structuring patterns of co-presence on the local to global scale in the urban areas beyond its compounds. Language, culture, and ethnicity can be said to play a diverse but evolving role in shaping co-presence and co-absence in the city,

from its beginnings as a spatial divide, to its role in bringing different groups of divided people into spaces of vicinity. Its eventual role was as a tool of social engineering, where it played its role in unifying segregated groups of people with a common language - English, but different languages still maintain their individual presence in their respective historic quarters.

Chapter 7: Conclusion

The underlying spatial logic of central Singapore has been shaped by the evolving ethnic discourse, and by extension, language. Urban morphology is a significant part of urban social discourse - Penn explains in 'Cognition and the City' (Penn, 2018) that built environment configurations are intertwined with social forms. This directly affects social relationships and the patterns of movement by people in space due to the restriction of movement and visibility (Hillier et al, 1993), and thus on patterns of co-presence. Therefore, inhabiting these spaces creates the field of co-presence and awareness, forming part of the intersubjective reality that individuals share as part of society in a feedback loop. This is supported in the Actor-Network Theory (Yaneva, 2009) where it states that design is inevitably socially linked. Conscious decisions from individuals affect their societal choices, which creates collective social feedback within co-presence spaces. Urban morphology can be viewed as 'objects' manifested through human sociological progress with looping effects on society and the economy (Penn, 2018). As such, the goal of multiracialism and the current ethnic equality discourse is inevitably linked to Singapore's urban morphology. In a study in postcolonial multiculturalism, hegemony is said to be built from the ground up due to the pluralist situation in previously divided and ethnically segregated communities (Goh, 2008). The politics of multiculturalism transcends issues of tolerance and cultural survival but evolves into the public recognition of equal worth (Charles Taylor, 1994). Therefore, present day social reproduction in Singapore is the recognition of ethnically bounded categories which make up a public multicultural performance scripted by the state upon independence (Chua 2003; PuruShotam 2000).

In the analysis, we proved that the spatial logic of Singapore has been ethnically and linguistically bounded since the period of colonisation. This has translated into areas retaining strong ethnic cultural heritage in Singapore's historic centre till today. The spatial logic of ethnic enclaves began as intentional segregation – leading to the creation of spaces integral in the social reproduction of ethnic communities. This spatial programming prevails despite efforts towards ethnic conglomeration in the larger social discourse of Singapore through linguistic and housing reforms. These unique spaces have evolved to now act as cultural quarters which shape Singapore's centre through their rich ethnically based histories and diverse population. This piece of research has explored the spatial roles which the ethnic and linguistic discourse has played throughout Singapore's urban history. Moving on, this piece of work can act as an important framework in examining the dynamics of multiculturalism achieved in many modern-day cities. This is especially relevant in historic cities which evolved under the influence of international trade, or modern metropolises with an increasing immigrant population. The onus is also on urban planners to be culturally sensitive and aware in balancing existing spatial logic - while accommodating to emerging immigrant societies when planning for the future of modern multicultural cities.

Epilogue: Further Studies and Explorations

Studying the impacts of migrant communities on multicultural cities

Measures: Global cities such as London, Manhattan, or Shanghai with a diverse multi-ethnic mix.
Methodology: Cataloguing languages or cultural artifacts and architecture associated with migrant communities.

By documenting a series of different urban morphologies, the logic of ethnic enclaves might be decoded through how urban planning might approach the organisation of migrant communities. This study would produce a comparative framework on how different communities are organized in large cities.

Comparing the various approaches to the spatial integration of migrant communities

Measures: Global cities which have been successful (or unsuccessful) in accepting migrant communities.
Methodology: Multiple deprivation social analysis.

This is an extension of the previous suggested study which would look at the scales of multiple deprivation in different urban models. These look at present successes and failures in accepting migrant communities into the urban network, to catalogue different approaches to understanding and planning for ethnic enclaves.

Studying the impact of visibility on ethnic integration.

Measures: Presence of culturally significant retail shops, places of worship and the growth of cultural landmarks and commerce.
Methodology: Visibility graph analysis - testing if the visibility of landmarks and commercial shops contribute to their sustained presence or growth in an urban area.

This is a more technical approach in assessing local scale growth within different ethnic enclaves. Ideally it would be conducted in different cities to see if the visible presence of migrant communities contributed to the levels of tolerance and acceptance of that community into the local culture.

Glossary

Axial Map
The axial map is constructed by taking an accurate map and drawing a set of the shortest intersecting lines through all the spaces of the urban grid (Space Syntax Glossary, 2021).

Segment Analysis
Segment analysis is any analysis of a segment map, including topological, angular, and metric analyses. The segment is the section of axial line or street or path lying between two intersections (Space Syntax Glossary, 2021).

Integration (NAIN - Normalized Integration)
Integration is a normalised measure of distance from any space of origin to all others in a system. It predicts the to-movement potential of destinations, indicative of their levels of accessibility (Space Syntax Glossary, 2021).

Choice (NACH - Normalized Choice)
Choice measures how likely an axial line or a street segment is to be passed through on all shortest routes from all spaces to all other spaces in the entire system or within a predetermined distance (radius) from each segment. It predicts the through-movement potential of the route (Space Syntax Glossary, 2021).

Normalization (Choice)
It divides total choice by total depth for each segment in the system. This adjusts choice values according to the depth of each segment in the system, since the more segregated it is, the more its choice value will be reduced by being divided by a higher total depth number (Space Syntax Glossary, 2021).

Normalization (Integration)
Normalised angular integration aims to normalise angular total depth by comparing the system to the urban average (Space Syntax Glossary, 2021).

Clustering
Spatial grouping of locations, identified by k-means in this paper (Lloyd, 1957; MacQueen, 1967).

Co-presence
The group of people who may not know each other, or even acknowledge each other, who appear in spaces that they share and use. Co-present people are not a community, but they are said to be the raw material for the creation of a community (Hillier, 1996; Space Syntax Glossary, 2021)

Correspondent/Spatial
Sharing a relationship bound by local spaces. Relationships formed by physical proximity and interaction (Hillier and Hanson, 1984).

Non-correspondent/Transpatial
Actions or social relationships dominating over spatial interaction, emphasizing the global spatial structure over the local (Hillier and Hanson, 1984).

Modern Economy
Economy based on non-correspondent/transpatial relationships such as language and social hierarchy (Hillier and Hanson, 1984).

Rural Economy
Economy based on correspondent/spatial relationships that function on proximity to trade/location (Hillier and Hanson, 1984).

Ethnic Integration Policy (EIP)
The EIP is put in place to preserve Singapore's multi-cultural identity and promote racial integration and harmony. It ensures that there is a balanced mix of the various ethnic communities in HDB towns. The EIP limits are set at block/ neighbourhood levels based on the ethnic make-up of Singapore (HDB, 2021).

Housing Development Board (HDB)
Singapore's public housing authority, which plans and builds social housing estates. HDB also colloquially refers to social housing units (HDB, 2021).

Urban Redevelopment Authority (URA)
National urban planning authority of Singapore in charge of every aspect of urban planning (URA,2021).

Cantonese
Refers to the dialect or the community originating from the Chinese city of Guangzhou and its surrounding areas.

Eurasian
A person of mixed Asian and European ancestry.

Geylang
Geylang is said to be derived from the term lemongrass, or Kilang in Malay for its lemongrass plantations (NLB, 2021).

Hainanese
Refers to the dialect or the natives of Hainan Island in China.

Hokkien
Refers to the dialect or the community originating from the Chinese province of Fujian

Kampong/Kampung
Malay term referring to a village.

Sultan
A Muslim sovereign

Temenggong
An old Malay and Javanese title of nobility, usually given to the chief of public security. The Temenggong is usually responsible for the safety of the monarch (raja or sultan), as well as overseeing the state police and army.

Teochew
Refers to the dialect or the community originating from the Chinese area of eastern Guangdong

Bibliography

Main Report

Anderson, Benedict. 2006. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso.

Bass, Jerry. 1986. “Conflict and Violence in Singapore and Malaysia, 1945–1983. By Richard Clutterbuck. (Boulder, CO: Westview Press, 1985. Pp. 398. $24.00.).” *American Political Science Review* 80 (3): 1043–44. https://doi.org/10.2307/1960590.

Benjamin, Geoffrey. 1976. “The Cultural Logic of Singapore’s ‘Multiracialism.’” *Singapore: Society and Transition*, Singapore: society and transition. - Kuala Lumpur [u.a.] : Oxford Univ. Pr., ISBN 0-19-580353-1. - 1976, p. 115-134, .

Crichlow, Warren. 2013. *Race, Identity, and Representation in Education*. Routledge.

D.), Harold E. Wilson (Ph. 1978. *Social Engineering in Singapore: Educational Policies and Social Change, 1819-1972*. Singapore University Press.

Durkheim, Emile. 1893. *Durkheim: The Division of Labour in Society*. Macmillan International Higher Education.

Fabian, Johannes. 2014. *Time and the Other: How Anthropology Makes Its Object*. Columbia University Press. https://doi.org/10.7312/fabi16926.

Fatt, Yong Ching. 1968. “A Preliminary Study of Chinese Leadership in Singapore, 1900–1941.” *Journal of Southeast Asian History* 9 (2): 258–85. https://doi.org/10.1017/S0217781100004701.

Giddens, A. 1985. “Time, Space and Regionalisation.” In . https://doi.org/10.1007/978-1-349-27935-7_12.

Go, Julian. 2004. “‘Racism’ and Colonialism: Meanings of Difference and Ruling Practices in America’s Pacific Empire.” *Qualitative Sociology* 27 (1): 35–58. https://doi.org/10.1023/B:QUAS.0000015543.66075.b4.

Goh, Daniel. 2008. “From Colonial Pluralism to Postcolonial Multiculturalism: Race, State Formation and the Question of Cultural Diversity in Malaysia and Singapore.” *Sociology Compass* 2 (January): 232–52. https://doi.org/10.1111/j.1751-9020.2007.00065.x.

Gopinathan, Saravanan. 1974. *Towards a National System of Education in Singapore, 1945-1973*. Oxford University Press.

Guo, Remy. 2016. *Urban Redevelopment: From Urban Squalor to Global City*. First edition. Urban Systems Studies. Singapore: Centre for Liveable Cities.

Hanson, J. 1989. “Order and Structure in Urban Design: The Plans for the Rebuilding of London after the Great Fire of 1666.” *Ekistics* 56 (334–335): 22–42.

Harvey, David. 1990. “Between Space and Time: Reflections on the Geographical Imagination1.” *Annals of the Association of American Geographers* 80 (3): 418–34. https://doi.org/10.1111/j.1467-8306.1990.tb00305.x.

Hillier, B. 2009. “Spatial Sustainability in Cities: Organic Patterns and Sustainable Forms.” *Hillier, B. (2009) Spatial Sustainability in Cities: Organic Patterns and Sustainable Forms. In: Koch, D. and Marcus, L. and Steen, J., (Eds.) Proceedings of the 7th International Space Syntax Symposium. Royal Institute of Technology (KTH), Stockholm, Sweden, p. 1.*, January.

Hillier, B., Ricky Burdett, J. Peponis, and Alan Penn. 1987. “Creating Life: Or, Does Architecture Determine Anything?” *Hillier, B. and Burdett, R. and Peponis, J. and Penn, A. (1987) Creating Life: Or, Does Architecture Determine Anything? Architecture & Comportement/ Architecture & Behaviour, 3 (3). Pp. 233-250. ISSN 03798585* 3 (June).

Hillier, B, Alan Penn, J Hanson, T Grajewski, and J Xu. 1993. “Natural Movement: Or, Configuration and Attraction in Urban Pedestrian Movement.” *Environment and Planning B: Planning and Design* 20 (January): 29–66. https://doi.org/10.1068/b200029.

Hillier, B., and Laura Vaughan. 2007a. “The City as One Thing.” *Hillier, B. and Vaughan, L. (2007) The City as One Thing. Progress in Planning, 67 (3). Pp. 205-230. ISSN 03059006* 67 (January).

———. 2007b. “The City as One Thing.” *Hillier, B. and Vaughan, L. (2007) The City as One Thing. Progress in Planning, 67 (3). Pp. 205-230. ISSN 03059006* 67 (January).
Hillier, Bill. 1996. *Space Is the Machine: A Configurational Theory of Architecture*. Cambridge ; New York, NY, USA: Cambridge University Press.
———. 2002. “A Theory of the City as Object: Or, How Spatial Laws Mediate the Social Construction of Urban Space.” *Hillier, B. (2002) A Theory of the City as Object: Or, How Spatial Laws Mediate the Social Construction of Urban Space. Urban Design International, 7 (3-4). Pp. 153-179. ISSN 13575317* 7 (December). https://doi.org/10.1057/palgrave.udi.9000082.
Hillier, Bill, and Julienne Hanson. 1984. *The Social Logic of Space*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511597237.
Hirschman, Charles. 1986a. “The Making of Race in Colonial Malaya: Political Economy and Racial Ideology.” *Sociological Forum* 1 (2): 330–61.
———. 1986b. “The Making of Race in Colonial Malaya: Political Economy and Racial Ideology.” *Sociological Forum* 1 (2): 330–61.
HO, Kong Weng, Haoming Liu, and Jinli Zeng. 2002. “Population, Education, Wage Gap and Growth.” *Singapore Economy in the 21st Century: Issues and Strategies*, January, 112–29.
Khan, S. S., K. Karimi, and Laura Vaughan. 2017. “The Tale of Ethno-Political and Spatial Claims in a Contested City.” In . https://doi.org/10.4324/9781315659275-7.
Kong, Lily, Yeoh, and B. A. 2003. *The Politics of Landscape in Singapore: Constructions of "Nation*.
Lee, Richard, and Karen Brodkin Sacks. 1993. “Anthropology, Imperialism and Resistance: The Work of Kathleen Gough.” *Anthropologica* 35 (2): 181–93. https://doi.org/10.2307/25605730.
Lefebvre, Henri, and Donald Nicholson-Smith. 2011. *The Production of Space*. Nachdr. Malden, Mass.: Blackwell.
Leifer, Michael. 1965. “Singapore In Malaysia: The Politics of Federation.” *Journal of Southeast Asian History* 6 (2): 54–70. https://doi.org/10.1017/S0217781100001885.
LePoer, Barbara Leitch. 1989. *Singapore : A Country Study*. Washington, D.C.: Federal Research Division, Libarary of Congress. https://www.loc.gov/item/90025755/.
L’Estoile, Benoît de, Federico Neiburg, and Lygia Maria Sigaud. 2005. *Empires, Nations, and Natives: Anthropology and State-Making*. Duke University Press.
Liang, Hong-Ming. 2003. “Ting-Hong Wong. Hegemonies Compared: State Formation and Chinese School Politics in Postwar Singapore and Hong Kong. New York: RoutledgeFalmer, 2002. 290pp. Cloth $85.00.” *History of Education Quarterly* 43 (3): 434–36. https://doi.org/10.1017/S0018268000017696.
Lily Zubaidah, Rahim. 2001. “The Singapore Dilemma: The Political and Educational Marginality of the Malay Community. By Lily Zubaidah Rahim. Kuala Lumpur: Oxford University Press, 1998. Xvii, 302 Pp. $49.95 (Cloth).” *The Journal of Asian Studies* 60 (4): 1242–44. https://doi.org/10.2307/2700097.
Liu, Hong, and Sin Kiong Wong. 2004. *Singapore Chinese Society in Transition: Business, Politics, & Socio-Economic Change, 1945-1965*. New York: Peter Lang.
Liu, Xintao, and Bin Jiang. 2012. “Defining and Generating Axial Lines from Street Center Lines for Better Understanding of Urban Morphologies.” *International Journal of Geographical Information Science* 26 (8): 1521–32. https://doi.org/10.1080/13658816.2011.643800.
Loh, Philip Fook Seng. 1975. *Seeds of Separatism: Educational Policy in Malaya, 1874-1940*. East Asian Social Science Monographs. Kuala Lumpur ; New York: Oxford University Press.
Luyt, Brendan. 2009. “Colonialism, Ethnicity, and Geopolitics in the Development of the Singapore National Library.” *Libraries & The Cultural Record* 44 (January). https://doi.org/10.1353/lac.0.0101.
———. 2012. “The Social Role of the Raffles Library, Singapore, in the Inter-War Years.” *Journal of Documentation* 68 (January): 134–43. https://doi.org/10.1108/00220411211200365.
Maiello, Amedeo. 1995. “Ethnic Conflict in Post-Colonial India.” In *The Postcolonial Question*. Routledge.
Ooi, Giok Ling. 1994. “National Identity, Public Housing and Conservation in Singapore.” *Habitat International* 18 (2): 71–80. https://doi.org/10.1016/0197-3975(94)90051-5.
Peponis, John, and Jean Wineman. 2002. “Spatial Structure of Environment and Behavior.” In *Handbook of Environmental Psychology*, 271–91. Hoboken, NJ, US: John Wiley & Sons, Inc.

Phua, Lily, and Brenda S. A. Yeoh. 1998. “Everyday Negotiations: Women’s Spaces and the Public Housing Landscape in Singapore.” *Australian Geographer* 29 (3): 309–26. https://doi.org/10.1080/00049189808703226.
Purushotam, Nirmala Srirekam. 2012. *Negotiating Multiculturalism*. *Negotiating Multiculturalism*. De Gruyter Mouton. https://www.degruyter.com/document/doi/10.1515/9783110801903/html.
Rokem, Jonathan, and Laura Vaughan. 2018. “Segregation, Mobility and Encounters in Jerusalem: The Role of Public Transport Infrastructure in Connecting the ‘Divided City.’” *Urban Studies* 55 (15): 3454–73. https://doi.org/10.1177/0042098017691465.
Seet, K. K. 1983. *A Place for the People*. Singapore: Times Books International.
Siddique, Sharon, and Nirmala Puru Shotam. 1982. *Singapore’s Little India: Past, Present, and Future*. Singapore: Institute of Southeast Asian Studies.
Sim, Loo Lee, Shi Ming Yu, and Sun Sheng Han. 2003. “Public Housing and Ethnic Integration in Singapore.” *Habitat International*, Learning from the past: international housing policy since 1945, 27 (2): 293–307. https://doi.org/10.1016/S0197-3975(02)00050-4.
Sin Chew Jit Poh [SCJP]. 1951a. “Educational Aid,” May 12, 1951.
———. 1951b, May 12, 1951.
———. 1951c. “Free Admission in English Schools,” May 16, 1951.
Sin, Chih. 2003. “The Politics of Ethnic Integration in Singapore: Malay ‘Regrouping’ as an Ideological Construct.” *International Journal of Urban and Regional Research* 27 (September): 527–44. https://doi.org/10.1111/1468-2427.00465.
Steinley, Douglas, and Michael J. Brusco. 2007. “Initializing K-Means Batch Clustering: A Critical Evaluation of Several Techniques.” *Journal of Classification* 24 (1): 99–121. https://doi.org/10.1007/s00357-007-0003-0.
Stewart, Lynn. 1995. “Bodies, Visions, and Spatial Politics: A Review Essay on Henri Lefebvre’s The Production of Space.” *Environment and Planning D: Society and Space* 13 (5): 609–18. https://doi.org/10.1068/d130609.
Straits Budget SB. 1953. “Bilingual Approach,” October 22, 1953.
Swee-Hock, Saw. 1969a. “Population Trends in Singapore, 1819-1967.” *Journal of Southeast Asian History* 10 (1): 36–49.
———. 1969b. “Population Trends in Singapore, 1819-1967.” *Journal of Southeast Asian History* 10 (1): 36–49.
———. 2012. *The Population of Singapore (Third Edition)*. Institute of Southeast Asian Studies.
Tan, Liok Ee. 1997. *The Politics of Chinese Education in Malaya, 1945-1961*. Oxford University Press.
Taylor, Charles. 1994. *The Politics of Recognition*. *Multiculturalism*. Princeton University Press. https://www.degruyter.com/document/doi/10.1515/9781400821402-004/html.
Turnbull, C. M. 2009. *A History of Modern Singapore, 1819-2005*. NUS Press.
Ulin, Robert. 1975. “Anthropology and the Colonial Encounter.” *Dialectical Anthropology* 1 (1): 293. https://doi.org/10.1007/BF00244593.
Vandenbosch, Amry. 1948. “FURNIVALL, J. S. Colonial Policy and Practice: A Comparative Study of Burma and Netherlands India. Pp. Xiii, 568. Cambridge: At the Cambridge University Press; New York: The Macmillan Company, 1948. $7.50.” *The ANNALS of the American Academy of Political and Social Science* 259 (1): 178–79. https://doi.org/10.1177/000271624825900151.
Vaughan, Laura, ed. 2015. *Suburban Urbanities: Suburbs and the Life of the High Street*. London: UCL Press.
Vaughan, Laura, C.E. Jones, Sam Griffiths, and Muki Haklay. 2010. “The Spatial Signature of Suburban Town Centres.” *The Journal of Space Syntax* 1 (January).
Watson, Keith. 1993. “Rulers and Ruled: Racial Perceptions, Curriculum and Schooling in Colonial Malaya and Singapore.” In *The Imperial Curriculum*. Routledge.
Wessendorf, Susanne. 2013. “Commonplace Diversity and the ‘Ethos of Mixing’: Perceptions of Difference in a London Neighbourhood.” *Identities* 20 (4): 407–22. https://doi.org/10.1080/1070289X.2013.822374.
Wilson, Hugh. 1993. Review of *Review of THE BRITISH AS RULERS: GOVERNING MULTIRACIAL SINGAPORE, 1867 - 1914*, by EDWIN LEE. *Journal of the Malaysian Branch of the Royal Asiatic Society* 66 (2 (265)): 116–18.

Wong, Ting-Hong. 2007. “Education and State Formation Reconsidered: Chinese School Identity in Postwar Singapore.” In *Transformations in Schooling: Historical and Comparative Perspectives*, edited by Kim Tolley, 41–65. New York: Palgrave Macmillan US. https://doi.org/10.1057/9780230603462_3.
Wright, Leigh. 1993. “The Fall of Imperial Britain in South-East Asia. By Nicholas Tarling. Singapore: Oxford University Press, 1993. Ix, 228 Pp.” *The Journal of Asian Studies* 52 (4): 1091–93. https://doi.org/10.2307/2059437.
Yaneva, Albena. 2009. “Making the Social Hold: Towards an Actor-Network Theory of Design.” *Design and Culture* 1 (November): 273–88. https://doi.org/10.2752/174967809X12556950208826.
Yeoh, Brenda S. A. 2003. *Contesting Space in Colonial Singapore: Power Relations and the Urban Built Environment*. NUS Press.

Referred Websites (National Archives, Library Records and Government Sites)

Chinatown Singapore. 2021. “History of Chinatown - Part of Singapore’s Heritage & Culture.” Chinatown Singapore. 2021. https://chinatown.sg/history-of-chinatown/.
“Communal Riots of 1964 | Infopedia.” n.d. Accessed June 4, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_45_2005-01-06.html.
Cornelius-Takahama, Vernon. 2004. “Kampong Glam | Infopedia.” 2004. https://eresources.nlb.gov.sg/infopedia/articles/SIP_249_2004-12-16.html.
———. 2005a. “Chinatown | Infopedia.” 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_734_2005-01-24.html.
———. 2005b. “Geylang | Infopedia.” 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_742_2005-01-20.html.
“HDB History and Towns - Housing & Development Board (HDB).” n.d. Accessed June 8, 2021. https://www.hdb.gov.sg/about-us/history.
“HDB’s Ethnic Integration Policy: Why It Still Matters.” n.d. Accessed June 8, 2021. http://www.gov.sg/article/hdbs-ethnic-integration-policy-why-it-still-matters.
“History of General Elections in Singapore | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_549_2004-12-28.html.
“History of Urban Planning in Singapore | Infopedia.” n.d. Accessed April 5, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1564_2009-09-08.html.
“Hock Lee Bus Strike and Riot | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_4_2005-01-06.html.
“HOUSING A NATION, BUILDING A CITY.” n.d. Accessed June 8, 2021. https://www.psd.gov.sg/heartofpublicservice/our-institutions/housing-a-nation-building-a-city.
“Jurong New Town and Jurong Industrial Estate.” n.d. Accessed June 8, 2021. https://www.roots.gov.sg/stories-landing/stories/jurong-industrial-estate/story.
Ministry of Trade and Industry - Department of Statistics. 2019. “Singapore Residents by Subzone and Type of Dwelling, 2011 - 2019.” Data.Gov.Sg. 2019. https://data.gov.sg/dataset/singapore-residents-by-subzone-and-type-of-dwelling-2011-2019.
Mittal, Ruchi. 2017. “Little India - A Cultural and Historical Precinct.” 2017. https://www.roots.gov.sg/stories-landing/stories/little-india-a-cultural-and-historical-precinct/story.
National Library Board. n.d. “First Master Plan Is Approved - Singapore History.” Accessed April 5, 2021. https://eresources.nlb.gov.sg/history/events/ef5af33f-bc66-4080-81d4-013564ba3119.
NLB. 2021. “First Census of Singapore Is Taken - Singapore History.” 2021. https://eresources.nlb.gov.sg/history/events/2fb8948b-5f16-4a7a-8e3c-7a724e1eb6ad.
Ong, Christopher. 2009. “Little India | Infopedia.” 2009. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1456_2009-02-11.html.
“Past Concept Plans.” n.d. Accessed June 8, 2021. https://www.ura.gov.sg/Corporate/Planning/Concept-Plan/Past-Concept-Plans.

"Public Housing in Singapore | Infopedia." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1585_2009-10-26.html.
Public Service Division. n.d. "HOUSING A NATION, BUILDING A CITY." Government Site. Accessed April 5, 2021. https://www.psd.gov.sg/heartofpublicservice/our-institutions/housing-a-nation-building-a-city.
Roots. n.d. "Jackson Plan." Accessed June 3, 2021. https://www.roots.gov.sg/stories-landing/stories/the-singapore-story-through-60-objects/colonial/jackson-plan/story.
"Singapore Attains Crown Colony Status - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/372a4e72-9f1b-4eb4-9ec6-58cad02000f0.
"Singapore Becomes Part of Malaysia - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/1dab53ea-788c-461c-acfb-ca625b974c9c.
"Singapore Improvement Trust | Infopedia." n.d. Accessed April 5, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_2016-03-14_142655.html.
Singapore, National Library Board. n.d. "The Work of the Singapore Improvement Trust, 1927-1947 / Compiled by J.M. Fraser." Accessed April 5, 2021. http://eservice.nlb.gov.sg/item_holding.aspx?bid=200072811.
Singapore Statutes. 2017. "Planning (Development of Land Authorisation for Last Approved Use) Notification 2017 - Singapore Statutes Online." 2017. https://sso.agc.gov.sg/SL-Supp/S231-2017/Published?DocDate=20170512&ProvIds=Sc-.
"Singapore's First Concept Plan Is Completed - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/c4c0b6bf-d674-4851-a3d4-fcc0b9d785d2.
Singstat. n.d. "Religion - Visualising Data." Base. Accessed July 30, 2021. http://www.singstat.gov.sg/find-data/search-by-theme/population/religion/visualising-data.
"Societies Ordinance Comes into Force - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/236e6276-e5c1-43ce-b988-bf3a89cf4328
"Story Map Journal." n.d. Accessed June 8, 2021. https://www.arcgis.com/apps/MapJournal/index.html?appid=3561723807e2431297f5238a23e3cc68
"Straits Settlements | Infopedia." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_2014-07-30_084623.html.
"Sun Yat Sen | Infopedia." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_845__2009-01-07.html
Tan, Bonny. 2005. "Raffles Town Plan (Jackson Plan) | Infopedia." 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_658_2005-01-07.html.
"The Chinese Protectorate | Infopedia." n.d. Accessed June 4, 2021a. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1346_2008-12-10.html.
"———." n.d. Accessed June 8, 2021b. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1346_2008-12-10.html.
"The Proteution of Chinese and Chines Interpretation." n.d. Accessed June 8, 2021. eresources.nlb.gov.sg/newspapers/Digitised/Article/straitstimes18771215-1.2.4.
"The Straits Settlements Is Dissolved - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/cf47ce98-0e14-4c1f-a6f7-cb55c99b4df6.

Historic Charts, Enclaves and Timeline

Benjamin, Geoffrey. 1976. “The Cultural Logic of Singapore’s ‘Multiracialism.’” *Singapore: Society and Transition*, Singapore: society and transition. - Kuala Lumpur [u.a.] : Oxford Univ. Pr., ISBN 0-19-580353-1. - 1976, p. 115-134.

Hirschman, Charles. 1986. “The Making of Race in Colonial Malaya: Political Economy and Racial Ideology.” *Sociological Forum* 1 (2): 330–61.

Kong, Lily, Yeoh, and B. A. 2003. *The Politics of Landscape in Singapore: Constructions of "Nation*.

Lily Zubaidah, Rahim. 2001. “The Singapore Dilemma: The Political and Educational Marginality of the Malay Community. By Lily Zubaidah Rahim. Kuala Lumpur: Oxford University Press, 1998. Xvii, 302).” *The Journal of Asian Studies* 60 (4): 1242–44. https://doi.org/10.2307/2700097.

Lim, Cheng Tju, Edgar Liao, Guo Quan Seng, and Kah Seng Loh, eds. 2012. “The Fajar Trial.” In *The University Socialist Club and the Contest for Malaya: Tangled Strands of Modernity*, 61–80. Amsterdam University Press. https://doi.org/10.1017/9789048515899.003.

Low, Cheryl-Ann, Darren Tan, Ibrahim bin Mohamed Tahir, Chong Ming Lim, Siti Hazirah Bte Mohamad, and Chui Hua Tan. 2021. “Kgglamtrail.Pdf.” National Heritage Board; Malay Heritage Centre; The Malay Heritage Foundation. https://www.nhb.gov.sg/~/media/nhb/files/places/trails/kampong%20glam/kgglamtrail.pdf.

Ng, Yew Peng. 2017. *What’s In The Name? How The Streets And Villages In Singapore Got Their Names*. World Scientific.

“References to Part I.” 2017. In *Singapore Eurasians*, by Myrna Braga-Blake, Ann Ebert-Oehlers, and Alexius A Pereira, 269–323. World Scientific. https://doi.org/10.1142/9789813109605_others03.

Rocha, Zarine L. 2011. “Multiplicity within Singularity: Racial Categorization and Recognizing ‘Mixed Race’ in Singapore.” *Journal of Current Southeast Asian Affairs* 30 (3): 95–131. https://doi.org/10.1177/186810341103000304.

Swee-Hock, Saw. 1969. “Population Trends in Singapore, 1819-1967.” *Journal of Southeast Asian History* 10 (1): 36–49.

“Living The Next Lap.” 1991. Urban Redevelopment Authority. https://www.ura.gov.sg/uol/~/media/User%20Defined/URA%20Online/publications/research-resources/plans-reports/ltnl.ashx.

Referred Websites (National Archives, Library Records and Government Sites)

“50 Years and Counting: Tracing the History of the National Day Parade.” n.d. Accessed July 12, 2021. https://www.roots.gov.sg/stories-landing/stories/50-years-and-counting/story.

“1824 Treaty of Friendship and Alliance | Infopedia.” n.d. Accessed June 3, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_2015-07-23_153326.html.

“1948 Legislative Council General Election - Singapore History.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/44e7b06b-05b0-4255-869f-1528a5ac35e7.

“1959 Legislative Assembly General Election - Singapore History.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/bad3de1d-21ce-48de-99b6-6e717e47328e.

“Cathedral of the Good Shepherd.” n.d. Accessed July 12, 2021. https://www.roots.gov.sg/places/places-landing/Places/national-monuments/cathedral-of-the-good-shepherd.

“Central Fire Station | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_857_2004-12-15.html.

Chinatown Singapore. 2021. “History of Chinatown - Part of Singapore’s Heritage & Culture.” Chinatown Singapore. 2021. https://chinatown.sg/history-of-chinatown/.

“Civilian War Memorial | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_516_2004-12-23.html.

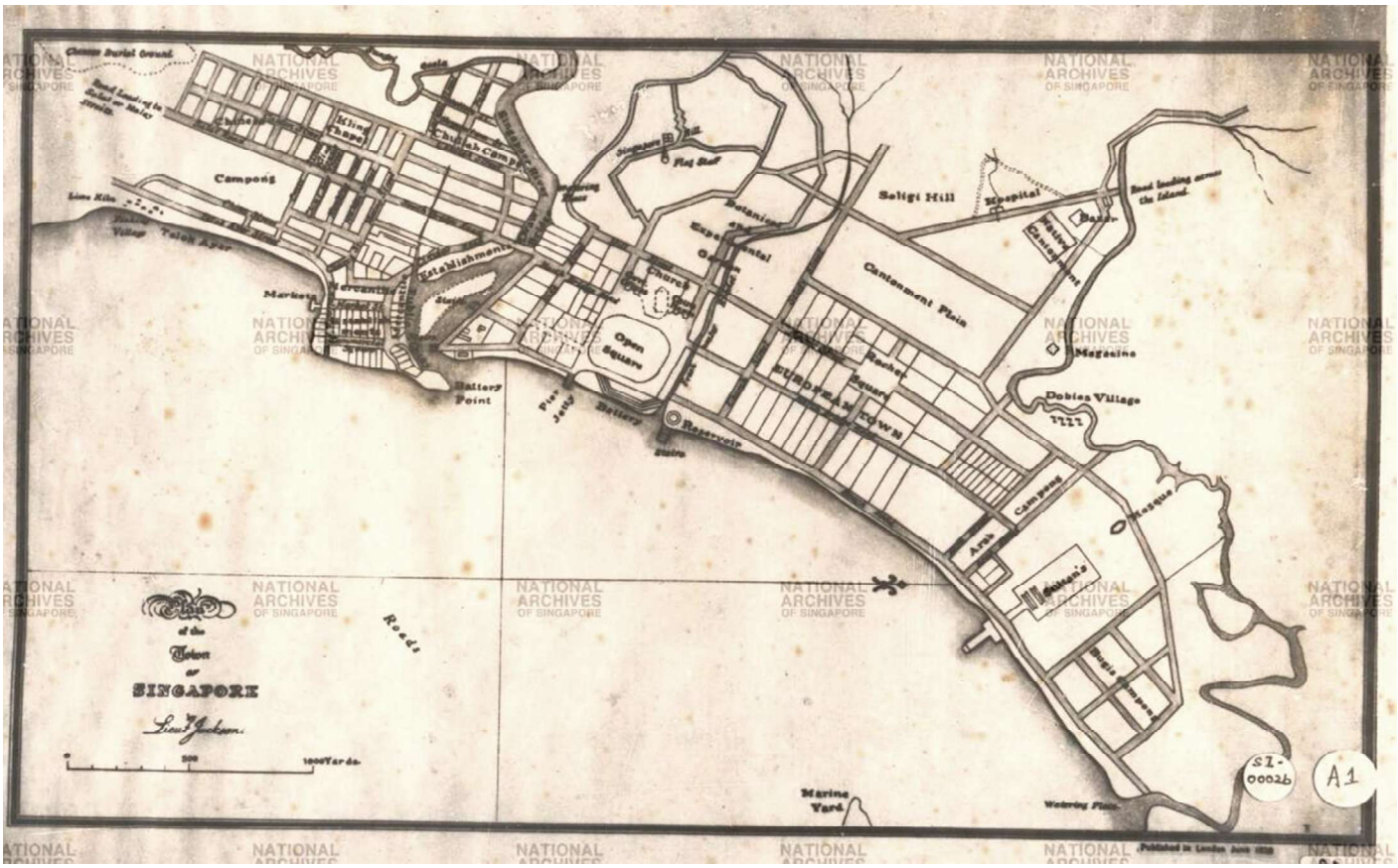
Cornelius-Takahama, Vernon. 2004. “Kampong Glam | Infopedia.” 2004. https://eresources.nlb.gov.sg/infopedia/articles/SIP_249_2004-12-16.html.
———. 2005a. “Chinatown | Infopedia.” 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_734_2005-01-24.html.
———. 2005b. “Geylang | Infopedia.” 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_742_2005-01-20.html.
“Former Cathay Building (Now The Cathay).” n.d. Accessed July 12, 2021. https://www.roots.gov.sg/places/places-landing/Places/national-monuments/former-cathay-building-now-the-cathay.
“Former City Hall | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_849_2004-12-17.html.
“Former Empress Place Building (Asian Civilisations Museum) | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1132_2006-04-05.html.
“Former St Joseph’s Institution (Singapore Art Museum) | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1625_2009-12-31.html.
“Former Supreme Court Building | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_774_2005-01-10.html.
“Former Tao Nan School (Now The Peranakan Museum).” n.d. Accessed July 12, 2021. https://www.roots.gov.sg/places/places-landing/Places/national-monuments/former-tao-nan-school-now-the-peranakan-museum.
“HDB History and Towns - Housing & Development Board (HDB).” n.d. Accessed June 8, 2021. https://www.hdb.gov.sg/about-us/history.
“HDB’s Ethnic Integration Policy: Why It Still Matters.” n.d. Accessed June 8, 2021. http://www.gov.sg/article/hdbs-ethnic-integration-policy-why-it-still-matters.
“History of General Elections in Singapore | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_549_2004-12-28.html.
“Hock Lee Bus Strike and Riot | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_4_2005-01-06.html.
“HOUSING A NATION, BUILDING A CITY.” n.d. Accessed June 8, 2021. https://www.psd.gov.sg/heartofpublicservice/our-institutions/housing-a-nation-building-a-city.
“Japanese Surrender | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_123_2005-02-03.html.
“Jurong New Town and Jurong Industrial Estate.” n.d. Accessed June 8, 2021. https://www.roots.gov.sg/stories-landing/stories/jurong-industrial-estate/story.
Kampong Glam. 2020. “Pondok Java: The Centre of Javanese Culture and Birth Place of Satay.” *Visit Kampong Gelam* (blog). 2020. https://visitkamponggelam.com.sg/article/pondok-java-the-centre-of-javanese-culture-and-birth-place-of-satay/.
Mittal, Ruchi. 2017. “Little India - A Cultural and Historical Precinct.” 2017. https://www.roots.gov.sg/stories-landing/stories/little-india-a-cultural-and-historical-precinct/story.
“National Museum of Singapore | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_2015-08-31_132917.html.
“Old Hill Street Police Station | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_727_2005-01-13.html.
Ong, Christopher. 2009. “Little India | Infopedia.” 2009. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1456_2009-02-11.html.
“Past Concept Plans.” n.d. Accessed June 8, 2021. https://www.ura.gov.sg/Corporate/Planning/Concept-Plan/Past-Concept-Plans.
“Public Housing in Singapore | Infopedia.” n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1585_2009-10-26.html.
“Raffles Hotel | Infopedia.” n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_37_2005-01-05.html.

"Raffles Town Plan (Jackson Plan) | Infopedia." n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_658_2005-01-07.html.
Ramlan, Nuradilah. 2011. "Pondok Peranakan Gelam Club | Infopedia." 2011. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1791_2011-03-02.html.
Roots. n.d. "Jackson Plan." Accessed June 3, 2021. https://www.roots.gov.sg/stories-landing/stories/the-singapore-story-through-60-objects/colonial/jackson-plan/story.
"Singapore - A Flourishing Free Port." n.d. Accessed June 8, 2021. http://countrystudies.us/singapore/5.htm.
"Singapore Becomes Part of Malaysia - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/1dab53ea-788c-461c-acfb-ca625b974c9c.
Singapore Statutes. 2017. "Planning (Development of Land Authorisation for Last Approved Use) Notification 2017 - Singapore Statutes Online." 2017. https://sso.agc.gov.sg/SL-Supp/S231-2017/Published?DocDate=20170512&ProvIds=Sc-.
"Singapore's First Concept Plan Is Completed - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/c4c0b6bf-d674-4851-a3d4-fcc0b9d785d2.
"Societies Ordinance Comes into Force - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/236e6276-e5c1-43ce-b988-bf3a89cf4328.
"St Andrew's Cathedral | Infopedia." n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_25_2_2008-12-01.html.
"Stories They Tell: Monuments and Singapore during the Japanese Occupation." n.d. Accessed June 8, 2021. https://www.roots.gov.sg/stories-landing/stories/stories-they-tell-monuments-and-singapore-during-the-japanese-occupation/story.
"Story Map Journal." n.d. Accessed June 8, 2021. https://www.arcgis.com/apps/MapJournal/index.html?appid=3561723807e2431297f5238a23e3cc68.
"Sun Yat Sen | Infopedia." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_845__2009-01-07.html
Tan, Bonny. 2005. "Raffles Town Plan (Jackson Plan) | Infopedia." 2005. https://eresources.nlb.gov.sg/infopedia/articles/SIP_658_2005-01-07.html.
"The Arts House (Old Parliament House) | Infopedia." n.d. Accessed July 12, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_836_2005-01-06.html.
"The Chinese Protectorate | Infopedia." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/infopedia/articles/SIP_1346_2008-12-10.html.
"The European Town in Colonial Singapore." n.d. Accessed July 12, 2021. https://www.roots.gov.sg/Collection-Landing/listing/1191100.
"The Straits Settlements Is Dissolved - Singapore History." n.d. Accessed June 8, 2021. https://eresources.nlb.gov.sg/history/events/cf47ce98-0e14-4c1f-a6f7-cb55c99b4df6.
URA. 2021. "Conservation Portal -." 2021. https://www.ura.gov.sg/Conservation-Portal/Explore/History?bldgid=GYLG.
"Victoria Theatre and Concert Hall." n.d. Accessed July 12, 2021. https://www.roots.gov.sg/places/places-landing/Places/national-monuments/victoria-theatre-and-concert-hall.

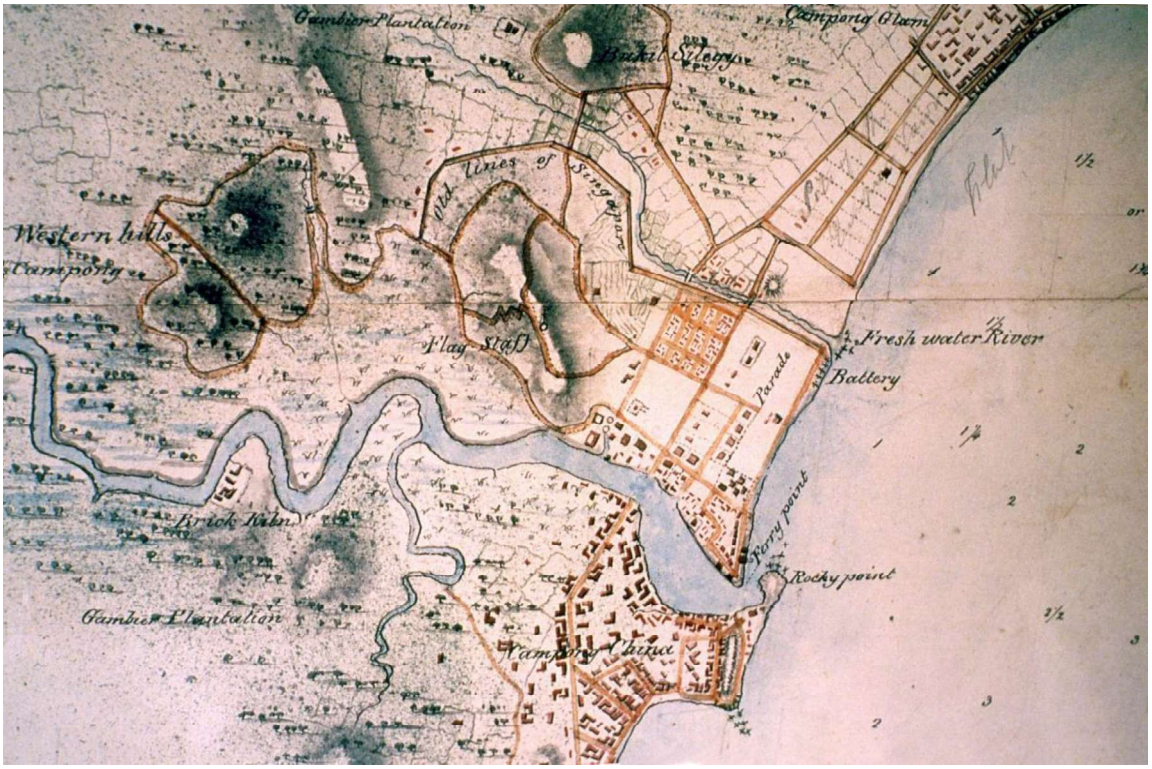
Appendices

Appendix 1 Historical Maps

Historical maps gathered from the national archives, used as the base reference for creating historical segment maps (results and relevant map references already shown in the main body).



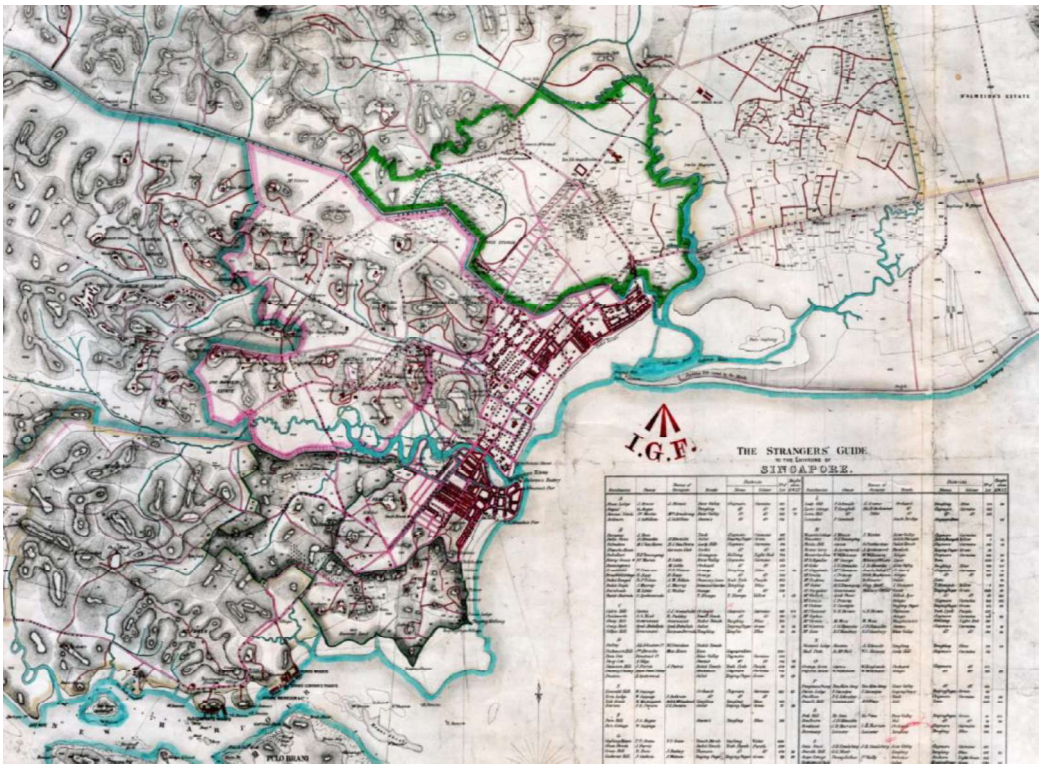
1822 Jackson Plan



1825 Map

1836 Map

1846 Map

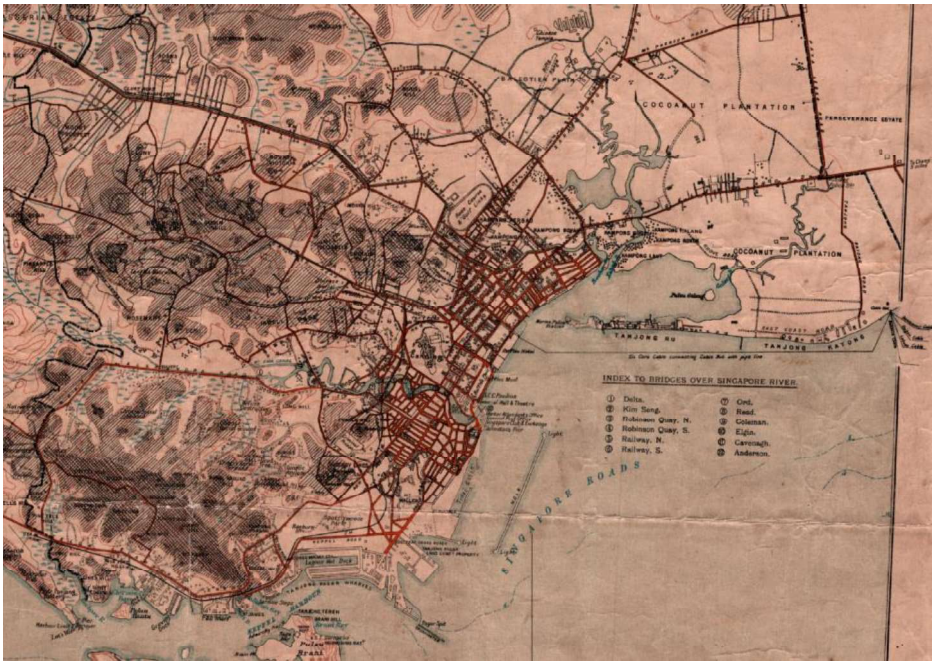


1860 Map

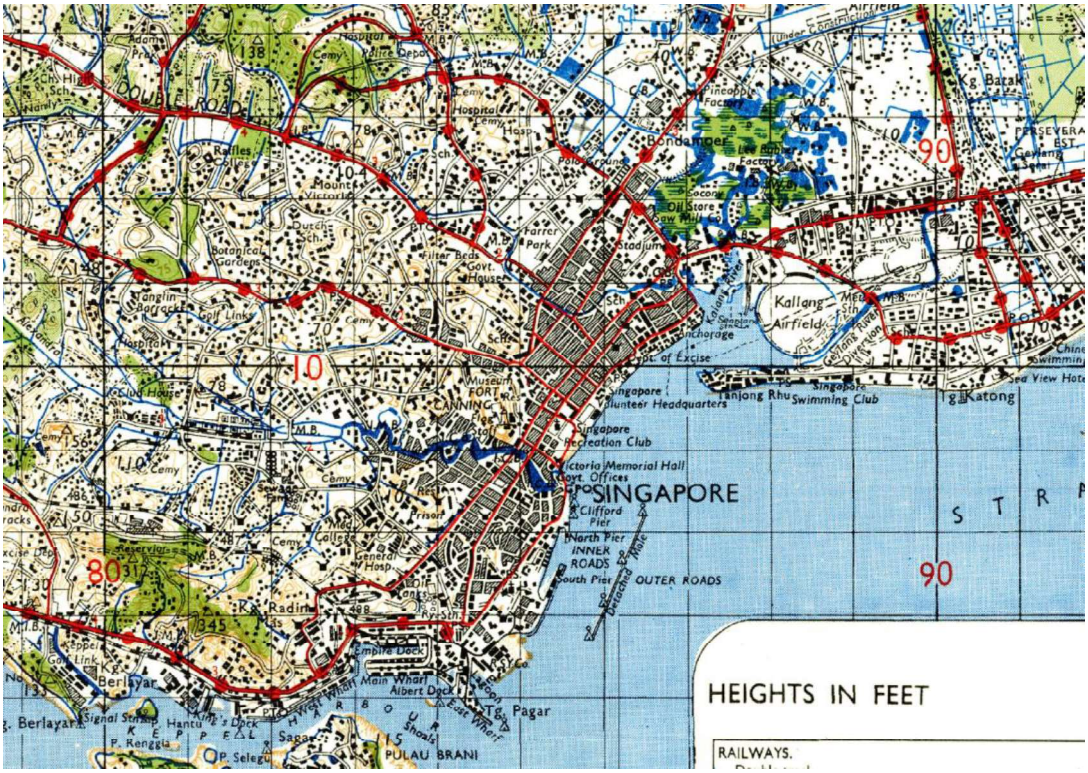
1873 Map

1905 Map

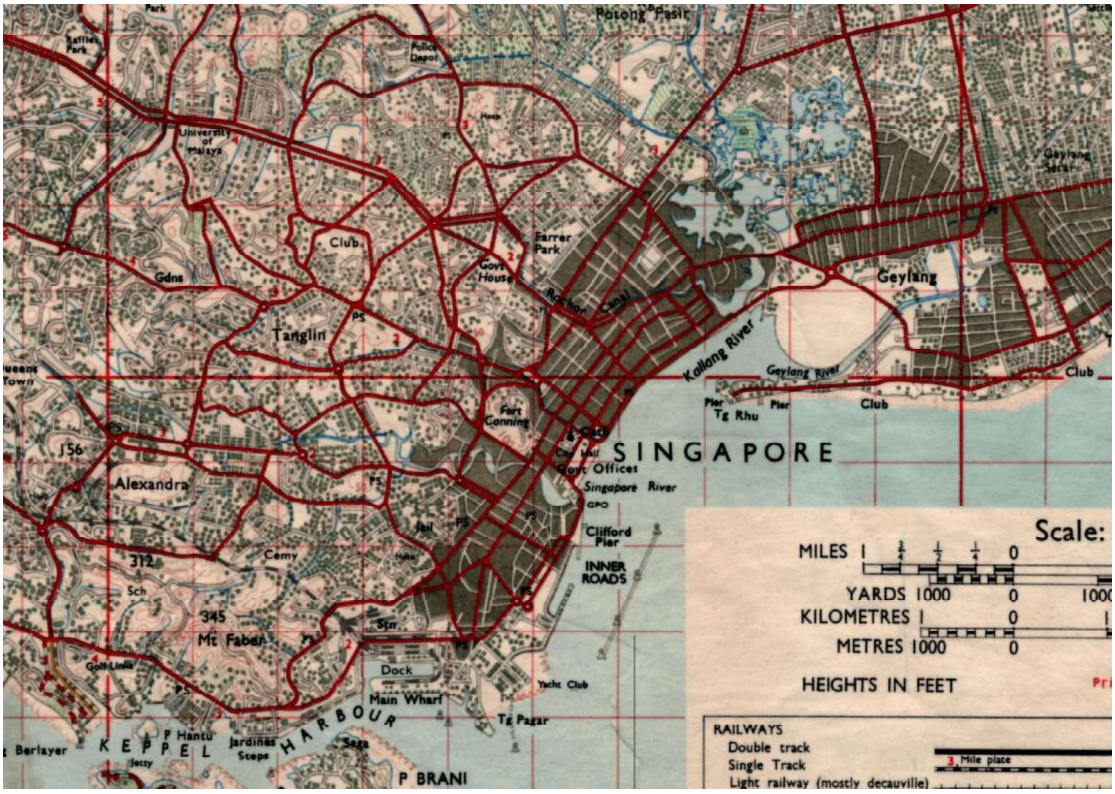
1932 Map



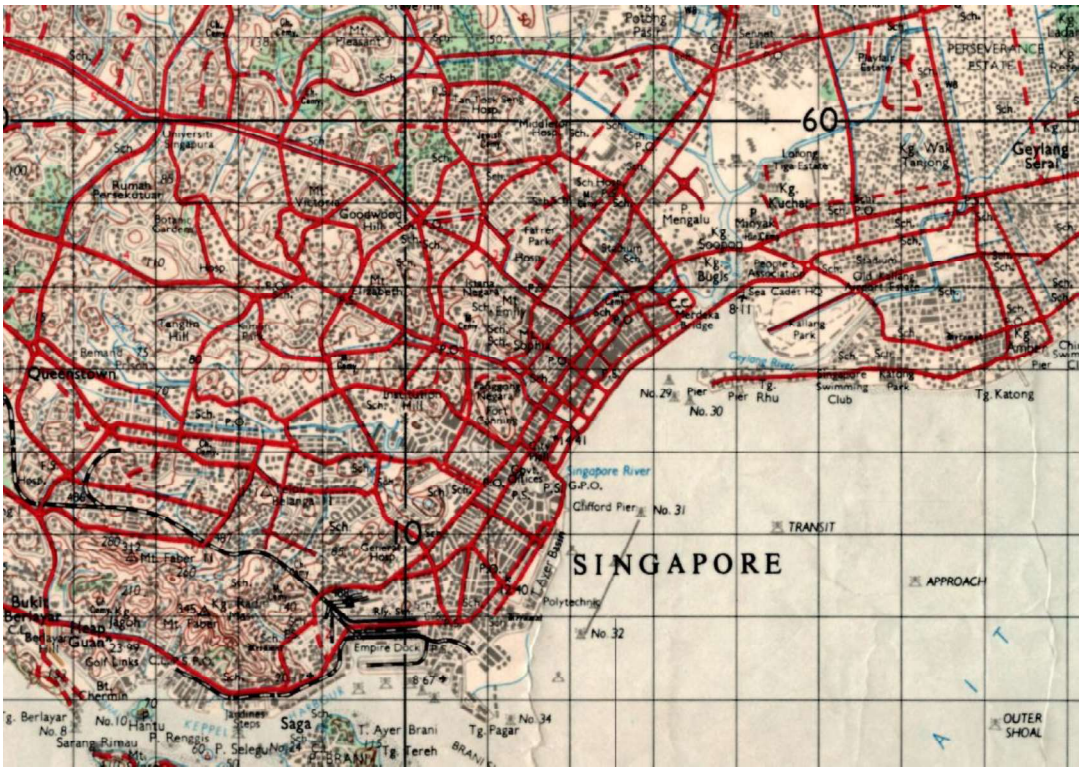
1914 Map



1945 Map



1958 Map



1969 Map

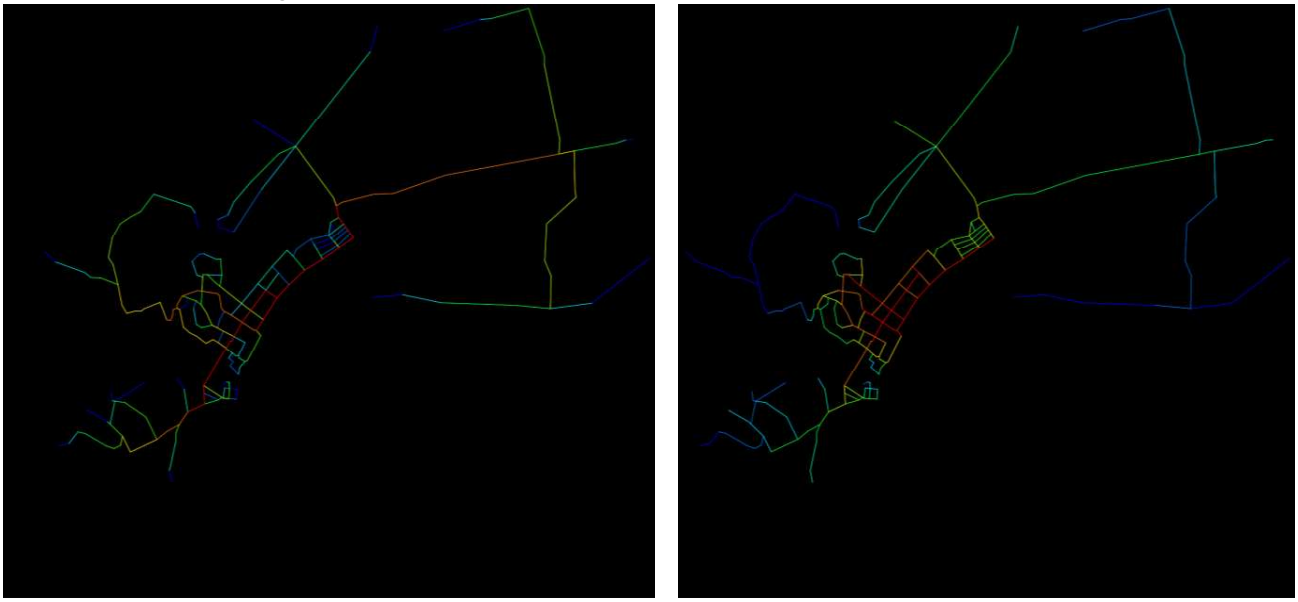
1974 Map


NEW TOWN
QUEENSTOWN
Tg. Rhu
EXPLOSIVES ANCHO
Approach
MAN-OF-WAR
ANCHORAGE
Marina South
EASTERN
EASTERN WORKING ANCHORAGE
HARBOUR
Tg. Pagar
Tg. Berlayar
Tg. Rimau
1987 Map

Appendix 2 Historical Segment Maps (Analysed)

These are additional historical maps that have been analysed but not included in the main text due to the lack of accuracy/clarity of data in the original maps. Additionally, these maps might not have been relevant to the analysis as it did not capture significant changes or important periods in Singapore's history.

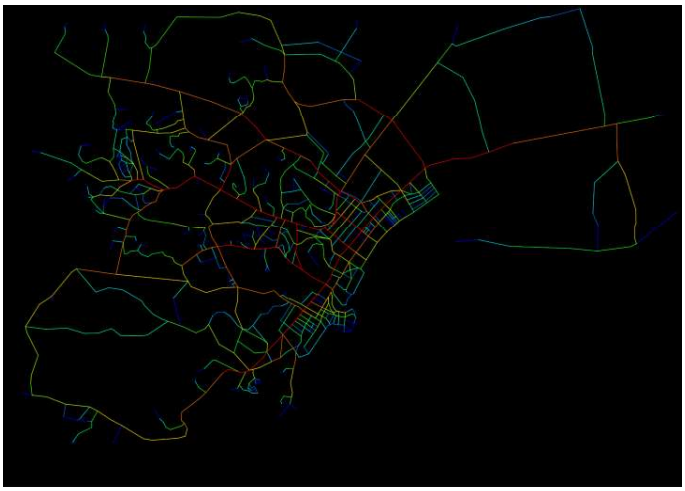
1822 Choice and Integration



1825 Choice and Integration


1836 Choice and Integration


1860 Choice and Integration




1873 Choice and Integration


1905 Choice and Integration


1932 Choice and Integration


1958 Choice and Integration


1968 Choice and Integration


1974 Choice and Integration