



40 years of spatial demographic changes: Racial segregation in peninsular Malaysia

Nur Faziera Yaakub, Tarmiji Masron

Centre for Spatially Integrated Digital Humanities, Faculty of Social Sciences & Humanities,
Universiti Malaysia Sarawak

Correspondence: Nur Faziera Yaakub (email: sdgiszaziera@gmail.com)

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Abstract

The implementation of the New Economic Policy (NEP) had taken place in peninsular Malaysia for 20 years (1970-1990). It was formulated as a social re-engineering in the aftermath of the 13th of May 1969 Incident. The NEP was “as simple as two eyes” because it targeted to eradicate poverty and at the same time to restructure society in order to eliminate the identification of race with economic function. The objectives reflected that the NEP was focusing on demographic aspects, particularly targeted at eyeing the division of races based on economic function. In conjunction with that, this article aims to study the changes in racial segregation in peninsular Malaysia from 1980 until 2010. To strengthen the findings, this article introduces spatial elements to geo-visualize the long-term changes in the spatial pattern of racial segregation in peninsular Malaysia. In terms of statistical analysis, racial segregation was calculated by using the Entropy Index. In the course of spatial analysis, the results were then being mapped by applying Geographic Information Systems (GIS) according to each district in peninsular Malaysia. Generally, the results divulge that from the year 1980 to 2010, districts in peninsular Malaysia experienced medium segregation of H value between 0.6144-0.7339. However, in detail, the value varied across each district. It was observed that the majority of districts on the East Coast experienced a high degree of racial segregation compared to the majority of districts on the West Coast.

Keywords: Entropy index, geographic information systems, new economic policy, race, spatial demography and segregation

Introduction

From a global point of view, the plethora of population diversity is an infinite study. As a matter of course, it leads and introduces us to a broad field of demography. Demography is defined as the scientific study of human populations (Raymer et al., 2018; Anderson, 2015). According to the Department of Statistics Malaysia (2020), demography is a field that focuses on the study of

population, especially fertility, mortality, marriage & divorce, and migration. It includes the scientific study of the size, distribution as well as the composition of spaces and how these three (3) components vary over time. Examples of demographic data are ethnic composition, age, sex ratio, marital status, and religion (Department of Statistics Malaysia, 2010). With that, demography or demographic means the study of population that comprises of big data about people at any place.

In conjunction with the broad field of demography stated previously, this article pivots on the spatial demographic changes that took place since the establishment of the NEP. Looking back to a few decades ago, the NEP was specified as the starting point for demographics changes in peninsular Malaysia because one (1) of its objectives involved the restructuring of the society. In particular, demographics changes in this study focuses on the racial segregation issue. “Segregation is the spatial separation of population groups and is usually manifested by the spatial distribution of minority population” (Wong, 1993, p. 559). Segregation refers to the social differences that exist spatially and forms a significant pattern (Johnston et al., 2000). For this research paper, racial segregation plays a role as the indicator to examine the achievement level of the NEP objectives, which is to eradicate poverty and to restructure society in order to eliminate the identification of race with economic function over space and time.

Literature review

On the 13th of May 1969, there was a political crisis happened in Kuala Lumpur. Consequently, leaving damages in terms of racial tension especially between the Malays and Chinese. As a result, the NEP was formulated as a social re-engineering in the aftermath of the unpleasant incident (Che Abdul Daim, 2019; Shamsul Amri, 2012). As the creation and implementation of the NEP took place from 1970 until 1990, this research paper aims to study the long-term changes in the spatial pattern of racial segregation in peninsular Malaysia from 1980 until 2010. The analysis and results will show the spatial changes that happen over time for all districts in peninsular Malaysia.

Previously, in Malaysia, many scholars have conducted researches on segregation, mainly focusing on one (1) state. For instance, Mohd Faris et al. (2016) mapped the racial segregation in Perak, Malaysia from the year 1991 until 2000. The output was calculated by using Entropy Index. The unit of analysis used was at the district and block computation (BP) level. Generally, they found that racial segregation in Perak experienced a downward trend. Also, Ruslan and Tarmiji (2001) used the Entropy Index to calculate the racial segregation in Pulau Pinang, Malaysia for the year 1980 until 1991. The unit of analysis used was at the sub-district (mukim) level. It was found that the mean of the index of racial segregation that took place in Pulau Pinang from the year 1980 until 1991 was intangible and insignificant. However, in detail, there were also sub-districts (mukim) with high segregation levels.

In the United States, Anderson et al. (2003) conducted a research on household income and it was found that, despite the reducing racial segregation level, blacks still made up a major portion of those who were living with low-income. Also, Massey et al. (2009) examined racial segregation by focusing on the civil rights of black and white. It was also found that racial segregation among black and white was much greater in 2000 compared to 1970.

Furthermore, to strengthen the findings, this research paper introduces spatial elements to geo-visualize the long-term changes of racial segregation in peninsular Malaysia. There have been many academic discussions about the successes and weaknesses of the NEP from previous scholars, but they did cover only from the perspective of the policy itself and leaving the spatial

element behind. Typically, a research would only highlight answers for the element of “what” and “when”, but the addition of spatial element gives answers for the question of “where” by including spatial data and mapping operation. It means, instead of only producing values and magnitude for racial segregation from the analysis, this study also maps the results accordingly to each area.

Mark (2000), GIScience acts as the basic research field that strives to redefine geographic concepts and their use in the context of GIS. In other words, GIScience plays a role as scientific knowledge or science behind GIS (Goodchild, 2009). While, Burrough (1986) defines GIS as a set of tools to collect, store, retrieve, modify, and display spatial data from the real world for a particular need. It means, both GIScience and GIS act as tools in comprehending spatial elements. Therefore, instead of only presenting the results using tables, this research paper geo-visualizes the results by using maps.

Tarmiji et al. (2018) applied GIS in analyzing the fatal accident rate involving all vehicle types in the North East District of Penang. For the methods, the authors used the Average Nearest Neighbor (ANN) and Kernel Density Estimation (KDE) to analyze the fatal accident spatial pattern. The result of ANN showed that the fatal accident patterns for 2011, 2012, and 2013 were clustered, with the null hypothesis is rejected while the result of KDE showed that most fatal accident blackspot areas took place at main road areas or segments. Nur Faziera et al. (2020) mapped the density of three (3) main groups of population in Malaysia, namely school-age of 10 to 19-year-old, productive age of 20 to 59-year-old, and elderly population 60-year-old and above. The findings stated that the population in the Federal Territory of Kuala Lumpur, Johor Bharu, and Kuching did record a high exposure to COVID-19.

Methodology and study area

Malaysia was chosen as the research location for this research paper. This research paper precisely focusing on peninsular Malaysia because it was associated with the creation and implementation of the NEP. peninsular Malaysia, which was formerly known as Malaya is located in Southeast Asia. As of today, there are 11 states and two (2) federal territories in peninsular Malaysia. Besides, states in peninsular Malaysia (West Malaysia) are divided into four (4) regions. Namely are Northern Region (Perlis, Kedah, Penang, and Perak), Central Region (Selangor, Wilayah Persekutuan Kuala Lumpur, Negeri Sembilan, and Melaka), Eastern Region (Kelantan, Terengganu, and Pahang), and Southern Region (Johor) (Mohamed and Asan Ali, 2003).

Table 1 shows the composition of races in peninsular Malaysia from the year 1980 until 2010. The percentages evidently indicate that Malay made up more than half of the percentage for each census data, followed by Chinese, Indian, and Others.

Table 1. Composition of races in peninsular Malaysia, 1980-2010 (%).

Year Race	1980	1991	2000	2010
Malay	56.02	59.96	62.60	64.03
Chinese	33.36	27.87	27.25	26.30
Indian	9.99	9.98	9.38	9.05
Others	0.63	2.19	0.77	0.62
Total	100	100	100	100

Spatial and Non-Spatial Data

The non-spatial data used in this research paper was specifically covered on the data of multiple races in peninsular Malaysia. Namely are Malay, Chinese, Indian, and others. The non-spatial data was sourced from the Population and Housing Census of Malaysia from the year 1980 until 2010. The census data was sorted by using Microsoft Office Excel before merging it into ArcGIS 10.3 for spatial analysis. Data stored in Microsoft Office Excel is easy to operate and load directly into the GIS software. While the spatial data for this research article included state and district maps of peninsular Malaysia. The spatial data were obtained through georeferencing and digitalizing process by using ArcGIS 10.3. As the unit of analysis for this research study is at the district level, the changes in the number of districts in peninsular Malaysia from 1980 until 2010 are stated in the following.

Number of districts in peninsular Malaysia (1980-2010)

Due to the increasing number of districts for each census, hence, four (4) different peninsular Malaysia Maps were used to conduct analysis for this research paper. Based on data from DoSM, the total number of districts in peninsular Malaysia for 1980, 1991, 2000, and 2010 Census were 78, 81, 83, and 87 respectively. From 1970 to 1980, there was an addition of eight (8) districts which were Kuala Krai, Jempol, Rompin, Perak Tengah, Gombak, Petaling, Sepang, and Wilayah Persekutuan Kuala Lumpur. From 1980 to 1991, there was an addition of three (3) districts which were Jeli, Maran, and Setiu. From 1991 to 2000, there were addition of two (2) districts which were Bera and Wilayah Putrajaya. Even though Wilayah Persekutuan Putrajaya has been established in 1995, it is, however, its data on the race for the 2000 Census is absent. From 2000 to 2010, there was an addition of four (4) districts which were Kulaijaya, Ledang, Pokok Sena, and Kampar. The maps prove that each of the new districts was either derived from one (1) district or the combination of parts of two (2) districts.

Entropy Index (H)

Dissimilarity indexes act as a principal statistic for measuring segregation (White, 1983). Generally, according to Iceland (2004), there are six (6) common dissimilarity indexes. Namely are Dissimilarity, Gini, Entropy, Squared Coefficient of Variation (CV), Relative Diversity, and Normalized Exposure. Many scholars have been debated over the suitability of the dissimilarity indexes (Cortese et al., 1976; Lieberman and Carter, 1982). However, among these indexes, Entropy Index or H value is the most suitable mathematical formula to be applied in measuring the racial segregation of all districts in peninsular Malaysia for this research paper. This is because Entropy Index has been proven of having a precise function in calculating the dissimilarity index with multi groups data (Reardon and Firebaugh, 2002).

Entropy, which acts as a measure of disorder, uncertainty or homogeneity is applicable for many different phenomena (Attaran & Zwick, 1987). Besides, Entropy Index is a measure of “evenness”, which means the extent to which groups are evenly distributed in the system as a whole (Massey & Denton, 1988; Theil, 1972). The formula of Entropy Index is as follows:

$$H_i = - \sum_{j=1}^k p_{ij} \ln(p_{ij})$$

P_{ij} = The ratio of j population in i area of which the number of j population is divided by the total number of population in that area

ln = Natural logarithm

Mathematically, the maximum value of H is $\ln(x)$ where x is the number of included groups in the calculation (Iceland, 2004). As the number of the main group of races in peninsular Malaysia is four (4), hence the number of groups used in this research paper is four (4); Malay, Chinese, Indian, and Others, hence the maximum value for H is $\ln(4) = 1.3863$. In order to ease the visualization in tables and maps, the maximum value of the index (1.3863) used to reflect the segregation level has been divided into five (5) intervals. Table 2 shows the classification of intervals.

Table 2. Classification of Entropy Index (H) and the Level of Segregation.

Entropy Index (H)	Segregation level
0 – 0.2773	High segregation
0.2774 – 0.5545	Medium-high segregation
0.5546 – 0.8318	Medium segregation
0.8319 – 1.1090	Medium-low segregation
1.1091 – 1.3863	Low segregation

Source: Ruslan and Tarmiji (2001)

Results and discussion

Table 3 below shows the calculation results of the Entropy Index (H) for the Housing Census of Malaysia from the year 1980 until 2010. The smaller the number, the higher the segregation level. While, the larger the number, the lower the segregation level. In ensuring precision, the figure for each H is detailed up to four (4) decimal places.

Table 3. Entropy Index (H) according to districts in peninsular Malaysia (1980-2010).

District	Entropy Index (H)			
	1980	1991	2000	2010
1. Batu Pahat	0.7429	1.0975	0.7196	0.7165
2. Johor Bahru	0.9499	1.0611	0.9807	0.9760
3. Kluang	0.9996	1.1158	0.9607	0.9428
4. Kota Tinggi	0.6034	0.7185	0.4913	0.5110
5. Mersing	0.6993	0.6631	0.4549	0.4371
6. Muar	0.8240	0.9851	0.8019	0.7856
7. Pontian	0.7170	1.0896	0.6903	0.6781
8. Segamat	0.9805	1.0959	0.9513	0.9223
9. Kulaijaya	-	-	-	0.9830
10. Ledang	-	-	-	0.8393
11. Baling	0.6390	0.5670	0.4395	0.3982
12. Bandar Baharu	0.8247	0.7621	0.6650	0.5932

13.	Kota Setar	0.7505	0.7203	0.6651	0.6610
14.	Kuala Muda	1.0040	0.9664	0.9197	0.8938
15.	Kubang Pasu	0.5613	0.5287	0.4845	0.4617
16.	Kulim	1.0563	0.9927	0.9563	0.9225
17.	Langkawi	0.4428	0.4048	0.3804	0.3178
18.	Padang Terap	0.3621	0.3397	0.3126	0.3054
19.	Sik	0.3770	0.3227	0.2934	0.2924
20.	Yan	0.4072	0.3596	0.2992	0.2571
21.	Pendang	0.5588	0.4962	0.4365	0.4104
22.	Pokok Sena	-	-	-	0.3303
23.	Bachok	0.0926	0.0819	0.0705	0.0811
24.	Kota Bharu	0.3689	0.3063	0.2508	0.2331
25.	Machang	0.2456	0.1981	0.1628	0.1620
26.	Pasir Mas	0.1982	0.1568	0.1281	0.1266
27.	Pasir Puteh	0.1524	0.1170	0.0834	0.0895
28.	Tanah Merah	0.2567	0.2602	0.2156	0.2069
29.	Tumpat	0.3644	0.3482	0.3244	0.3267
30.	Gua Musang	0.4883	0.3373	0.2653	0.2650
31.	Kuala Krai	0.3526	0.3070	0.2467	0.2297
32.	Jeli	-	0.0867	0.0218	0.0371
33.	Alor Gajah	0.8719	0.8755	0.7394	0.6951
34.	Jasin	0.8995	0.8872	0.7915	0.7282
35.	Melaka Tengah	0.9097	0.9127	0.8655	0.8474
36.	Jelebu	0.8375	0.8767	0.8319	0.7923
37.	Kuala Pilah	0.7421	0.7968	0.6749	0.6522
38.	Port Dickson	1.1062	1.1485	1.0701	1.0460
39.	Rembau	0.7499	0.7343	0.5958	0.5207
40.	Seremban	1.0731	1.1074	1.0671	1.0054
41.	Tampin	0.9816	0.9993	0.9447	0.9418
42.	Jempol	1.0392	0.9368	0.8375	0.8463
43.	Bentong	0.9720	1.0068	0.9594	0.9328
44.	Cameron Highlands	1.0780	1.0824	1.0377	1.0880
45.	Jerantut	0.5699	0.6170	0.5497	0.5312
46.	Kuantan	0.8056	0.7395	0.6909	0.6251
47.	Lipis	0.7153	0.6843	0.5828	0.5162
48.	Pekan	0.4292	0.2662	0.1922	0.1888
49.	Raub	0.9382	0.9431	0.9007	0.8649
50.	Temerloh	0.7268	0.9055	0.7948	0.7547
51.	Rompin	0.4013	0.3748	0.2359	0.2310
52.	Maran	-	0.3770	0.2637	0.2114
53.	Bera	-	-	0.8283	0.8270
54.	Seberang Perai Tengah	0.9949	1.0015	0.9882	0.9707
55.	Seberang Perai Utara	1.0072	0.9555	0.9066	0.8843
56.	Seberang Perai Selatan	1.0142	1.0429	1.0670	1.0632
57.	Timur Laut	0.9044	0.8772	0.8742	0.8721
58.	Barat Daya	0.8505	0.8906	0.8636	0.8592
59.	Batang Padang	1.0441	1.1035	0.9898	0.9184
60.	Manjung (Dinding)	1.0043	1.0812	1.0016	0.9751
61.	Kinta	0.9423	1.0199	1.0170	1.0215
62.	Kerian	0.8461	1.0031	0.7736	0.7301
63.	Kuala Kangsar	0.9654	0.9968	0.9445	0.9242
64.	Larut & Matang	0.9811	0.9701	0.9036	0.9023
65.	Hilir Perak	1.0411	1.2904	1.0175	1.0175
66.	Ulu Perak	0.8005	0.7244	0.6008	0.5343
67.	Perak Tengah	0.3000	0.4284	0.1994	0.1607
68.	Kampar	-	-	-	0.9558

69.	Perlis	0.6588	0.5723	0.5050	0.4555
70.	Gombak	1.0117	1.0357	1.0115	0.9566
71.	Klang	1.0662	1.2041	1.0795	1.0674
72.	Kuala Langat	1.0304	1.3382	0.9903	0.9136
73.	Kuala Selangor	0.9703	1.3065	0.8895	0.7411
74.	Petaling	1.0847	1.0900	1.0443	1.0000
75.	Sabak Bernam	0.7407	1.1546	0.7101	0.6656
76.	Sepang	1.0876	1.2783	0.9449	0.8772
77.	Ulu Langat	0.9761	1.0538	1.0056	0.9868
78.	Ulu Selangor	1.0851	1.1125	1.0317	0.8393
79.	Besut	0.1139	0.1052	0.0813	0.0958
80.	Dungun	0.2837	0.1863	0.1723	0.1404
81.	Kemaman	0.4151	0.3480	0.2413	0.2154
82.	Kuala Terengganu	0.2564	0.2142	0.1874	0.1764
83.	Marang	0.0907	0.1458	0.1036	0.1187
84.	Hulu Terengganu	0.1727	0.0755	0.0459	0.0439
85.	Setiu	-	0.0448	0.0335	0.0215
86.	Wilayah Persekutuan Kuala Lumpur	1.0250	1.0360	1.0337	0.9883
87.	Wilayah Persekutuan Putrajaya	-	-	-	0.1173
Mean		0.7261	0.7339	0.6389	0.6144
Minimum value		0.0907	0.0448	0.0218	0.0215
Maximum value		1.1062	1.3382	1.0795	1.0880

Racial segregation for the 1980 Census

Referring to Table 3, the mean of Entropy Index for the 1980 Census was 0.7261 with a minimum value of 0.0907 and a maximum value of 1.1062. However, not all districts did experience medium segregation levels as the H value varied among districts.

In detail, there were 10 districts with a high segregation level of H value between 0-0.2773. The districts from this circle were Bachok, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Besut, Dungun, Kuala Terengganu, Marang, and Hulu Terengganu. Ensuing, there were 12 districts for the medium-high segregation level of H value between 0.2774-0.5545. The listed districts were Langkawi, Padang Terap, Sik, Yan, Kota Bharu, Tumpat, Gua Musang, Kuala Krai, Pekan, Rompin, Perak Tengah, and Kemaman. Subsequently, there were 19 districts for the medium segregation level of H value between 0.546-0.8318. Namely were Batu Pahat, Kota Tinggi, Mersing, Muar, Pontian, Baling, Bandar Baharu, Kota Setar, Kubang Pasu, Pendang, Kuala Pilah, Rembau, Jerantut, Kuantan, Lipis, Temerloh, Ulu Perak, Perlis, and Sabak Bernam. Next, the number of districts with a medium-low segregation level of H value between 0.8319-1.1090 was 37 districts. Of the counted in districts were Johor Bharu, Kluang, Segamat, Kuala Muda, Kulim, Alor Gajah, Jasin, Melaka Tengah, Jelevu, Port Dickson, Seremban, Tampin, Jempol, Bentong, Cameron Highlands, Raub, Seberang Prai Tengah, Seberang Perai Utara, Seberang Perai Selatan, Timur Laut, Barat Daya, Batang Padang, Manjung (Dinding), Kinta, Kerian, Kuala Kangsar, Larut & Matang, Hilir Perak, Gombak, Klang, Kuala Langat, Kuala Selangor, Petaling, Sepang, Ulu Langat, Ulu Selangor, and Wilayah Persekutuan Kuala Lumpur. While there were no districts that fell under a low segregation level of H value between 1.1091-1.3863.

From a total of 78 districts in peninsular Malaysia, the majority of the districts fell under medium-low segregation. While the minority of the districts fell under high segregation levels. Figure 1 geo-visualizes that high segregation and medium-high segregation were concentrated in

Kelantan and Terengganu. While, medium-low segregation was concentrated in Kedah, Pulau Pinang, major areas in Perak, major areas in Selangor, Wilayah Persekutuan Kuala Lumpur, and Negeri Sembilan.

Racial segregation for the 1991 census

According to Table 3, the mean of Entropy Index for the 1991 Census was 0.7339 with a minimum value of 0.0448 and a maximum value of 1.3382. There were 13 districts with a high segregation level of H value between 0-0.2773. Namely were Bachok, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Jeli, Pekan, Besut, Dungun, Kuala Terengganu, Marang, Hulu Terengganu, and Setiu. Following, there were 14 districts for the medium-high segregation level of H value between 0.2774-0.5545. The comprised districts were Kubang Pasu, Langkawi, Padang Terap, Sik, Yan, Pendang, Kota Bharu, Tumpat, Gua Musang, Kuala Krai, Rompin, Maran, Perak Tengah, and Kemaman. Then, the number of districts with the medium segregation level of H value between 0.5546-0.8318 was 12. The included districts were Kota Tinggi, Mersing, Baling, Bandar Baharu, Kota Setar, Kuala Pilah, Rembau, Jerantut, Kuantan, Lipis, Ulu Perak, and Perlis. Subsequent, of the medium-low segregation level of H value between 0.8319-1.1090, there were 33 of all the total districts. The lists were Batu Pahat, Johor Bahru, Muar, Pontian, Segamat, Kuala Muda, Kulim, Alor Gajah, Jasin, Melaka Tengah, Jelebu, Seremban, Tampin, Jempol, Bentong, Cameron Highlands, Raub, Temerloh, Seberai Perai Tengah, Seberang Perai Utara, Seberang Perai Selatan, Timur Laut, Barat Daya, Batang Padang, Manjung (Dinding), Kinta, Kerian, Kuala Kangsar, Larut & Matang, Gombak, Petaling, Ulu Langat, and the Wilayah Persekutuan Kuala Lumpur. Whereas, the districts that fell under low segregation levels of H value between 1.1091-1.3863 were Kluang, Port Dickson, Hilir Perak, Klang, Kuala Langat, Kuala Selangor, Sabak Bernam, Sepang, and Ulu Selangor.

Therefore, from a total of 81 districts in eninsular Malaysia, the majority of the districts fell under medium-low segregation levels. While a minority of the districts fell under medium segregation level. Based on Figure 2, a high level and a medium-high level of segregation were concentrated in Kedah, Kelantan, and Terengganu. While the medium-low level and low level of segregation were concentrated in Pulau Pinang, major areas in Perak, Selangor, Wilayah Persekutuan Kuala Lumpur, major areas in Negeri Sembilan, Melaka, and major areas in Johor.

Racial segregation for the 2000 census

Based on Table 3, the mean of Entropy Index for the 2000 Census was 0.6389 with a minimum value of 0.0218 and a maximum value of 1.0795. However, not all districts did experience medium segregation levels as there were districts with other H values that indicate a different level of segregation.

There were 20 districts grouped as having high segregation level of 0-0.2773. The districts were Bachok, Kota Bharu, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Gua Musang, Kuala Krai, Jeli, Pekan, Rompin, Maran, Perak Tengah, Besut, Dungun, Kemaman, Kuala Terengganu, Marang, Hulu Terengganu, and Setiu. Following, of the medium-high segregation, there were 12 districts included in that level. The lists were Kota Tinggi, Mersing, Baling, Kubang Pasu, Langkawi, Padang Terap, Sik, Yan, Pendang, Tumpat, Jerantut, and Perlis. Afterward, there were 16 districts listed as the medium segregation level. That were Batu Pahat, Muar, Pontian, Bandar Baharu, Kota Setar, Alor Gajah, Jasin, Kuala Pilah, Rembau, Kuantan, Lipis, Temerloh, Bera,

Kerian, Ulu Perak, and Sabak Bernam. For the medium-low segregation, there were a total of 34 districts included. Namely were Johor Bahru, Kluang, Segamat, Kuala Muda, Kulim, Melaka Tengah, Jelebu, Port Dickson, Tampin, Jempol, Bentong, Cameron Highlands, Raub, Seberang Perai Tengah, Seberang Perai Utara, Seberang Perai Selatan, Timur Laut, Barat Daya, Batang Padang, Manjung (Dinding), Kinta, Kuala Kangsar, Larut & Matang, Hilir Perak, Perak Tengah, Gombak, Klang, Kuala Langat, Kuala Selangor, Petaling, Sepang, Ulu Langat, Ulu Selangor, and Wilayah Persekutuan Kuala Lumpur. While, there were no districts fell under low segregation level.

Hence, from a total of 82 districts in peninsular Malaysia, a high percentage of the districts fell under medium-low segregation levels. While a low percentage of the districts fell under medium-high segregation level. Based on Figure 3, the low Entropy Index was concentrated in major areas in Kedah, Kelantan, and major areas in Pahang. While, high Entropy Index was concentrated in major areas in Perak, Selangor, Wilayah Persekutuan Kuala Lumpur, Negeri Sembilan, Melaka, and major areas in Johor.

Besides, the total number of districts displayed on the map is 83. However, according to the 2000 Census by DoSM, the racial data for Wilayah Persekutuan Putrajaya was absent even though the federal territory was established in the year 1995. Hence, it was labeled as having 0 value.

Racial segregation for the 2010 census

As stated in Table 3, the mean of Entropy Index for the 2010 Census was 0.6144 with a minimum value of 0.0215 and a maximum value of 1.0880. However, particularly, the H value varied across all districts which indicated different levels of segregation.

The table also shows that 22 of the districts experienced high segregation level. Listed were Yan, Bachok, Kota Bharu, Machang, Pasir Mas, Pasir Puteh, Tanah Merah, Gua Musang, Kuala Krai, Jeli, Pekan, Rompin, Maran, Perak Tengah, Besut, Dungun, Kemaman, Kuala Terengganu, Marang, Hulu Terengganu, Setiu, and Wilayah Persekutuan Putrajaya. For the medium-high segregation, the number of included districts were 15. Namely were Kota Tinggi, Mersing, Baling, Kubang Pasu, Langkawi, Padang Terap, Sik, Pendang, Pokok Sena, Tumpat, Rembau, Jerantut, Lipis, Ulu Perak, and Perlis. Next, there were also 15 districts experienced medium segregation level. Namely were Batu Pahat, Muar, Pontian, Bandar Baharu, Kota Setar, Alor Gajah, Jasin, Jelebu, Kuala Pilah, Kuantan, Temerloh, Bera, Kerian, Kuala Selangor, and Sabak Bernam. Next, there were 35 districts for the medium-low segregation. Namely were Johor Bahru, Kluang, Segamat, Kulaijaya, Ledang, Kuala Muda, Kulim, Melaka Tengah, Port Dickson, Seremban, Tampin, Jempol, Bentong, Cameron Highlands, Raub, Seberang Perai Tengah, Seberang Perai Utara, Seberang Perai Selatan, Timur Laut, Barat Daya, Batang Padang, Manjung (Dinding), Kinta, Kuala Kangsar, Larut & Matang, Hilir Perak, Kampar, Gombak, Klang, Kuala Langat, Petaling, Sepang, Ulu Langat, Ulu Selangor, and Wilayah Persekutuan Kuala Lumpur. Despite the fact, there were no districts fell under low segregation level.

Hence, from a total of 87 districts in peninsular Malaysia, the majority of the districts fell under the medium-low level of segregation. While a minority of the districts fell under medium-high and medium segregation levels. Based on Figure 4, the distribution of low H value was concentrated in most areas in Kedah, Kelantan, Terengganu, most areas in Pahang, and Wilayah Persekutuan Putrajaya. While, the distribution of high H value was concentrated in most areas in Perak, Pulau Pinang, most areas in Selangor, and most areas in Negeri Sembilan.

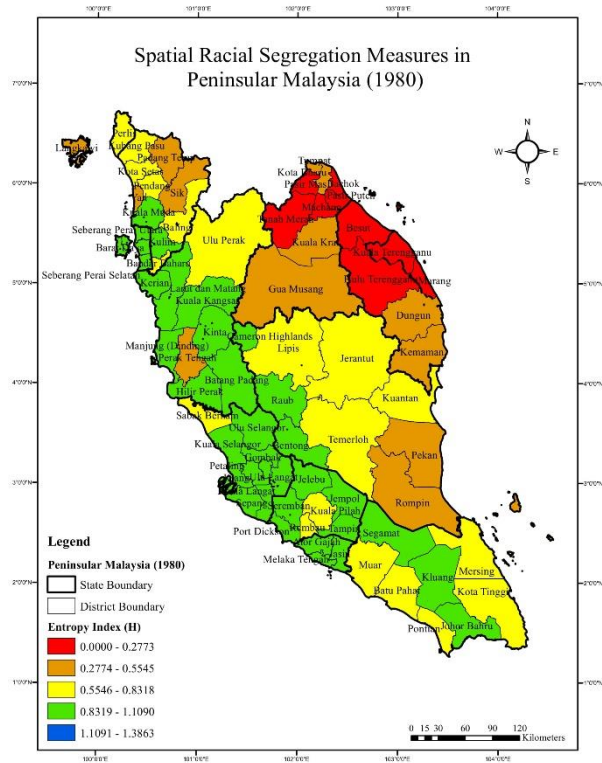


Figure 1. Spatial distribution of Entropy Index (H) in peninsular Malaysia (1980).

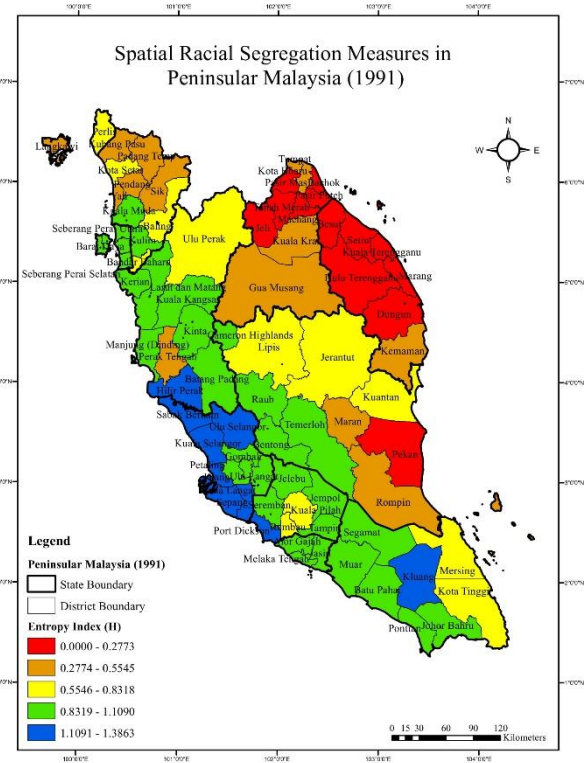


Figure 2. Spatial distribution of Entropy Index (H) in peninsular Malaysia (1991).

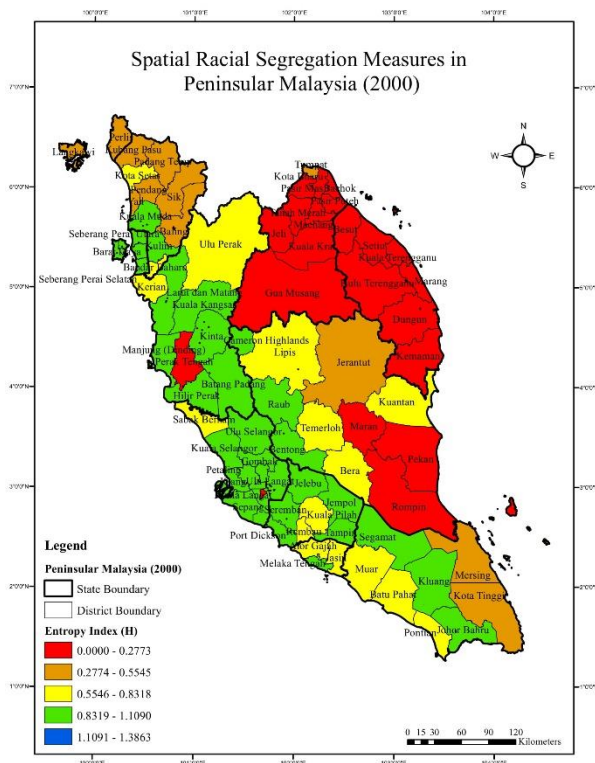


Figure 3. Spatial distribution of Entropy Index (H) in peninsular Malaysia (2000).

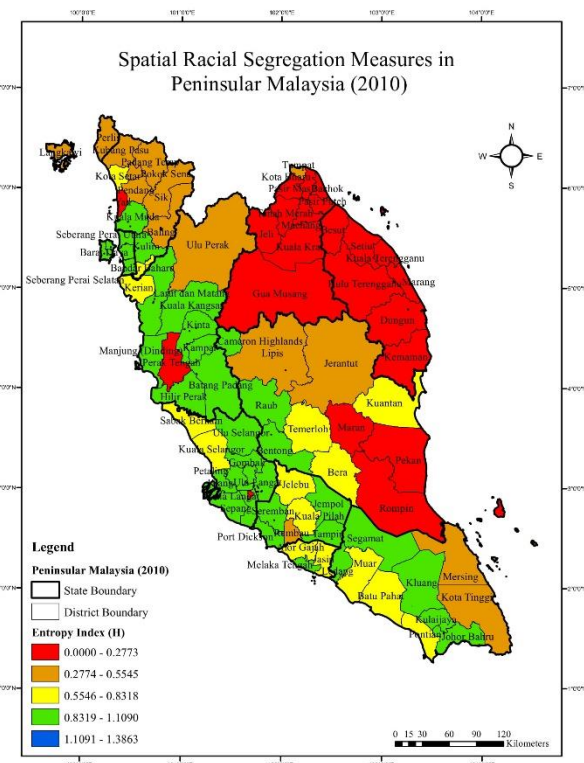


Figure 4. Spatial distribution of Entropy Index (H) in peninsular Malaysia (2010).

Comparison of racial segregation for 1980-2010 census

Table 4 shows the summary of differences in the number of districts in peninsular Malaysia for each level of segregation. The trend for high segregation increased from 10 districts to 22 districts in 40 years. While the trend for medium-high segregation experienced an increment in 1991, a reduction in 2000, and another increment in 2010. For medium segregation, there was a reduction in 1991 followed by an increment in 2000 and back to another reduction in 2010. The trend for medium-low segregation decreased in 1991 and increased for the next two (2) consecutive censuses. While there was no apparent trend for low segregation.

Table 4. Summary of number of districts in peninsular Malaysia (1980-2010).

Segregation level	Number of districts			
	1980	1991	2000	2010
High segregation	10	13	20	22
Medium-high Segregation	12	14	12	15
Medium segregation	19	12	16	15
Medium-low Segregation	37	33	34	35
Low segregation	0	9	0	0
Total number of districts	78	81	82	87

The low magnitude of segregation for most districts in Kedah, Perak, Selangor, Negeri Sembilan, Melaka, and Johor could be attributed to several factors. First, the effectiveness of the Malaysian Government policy in restructuring society through the implementation of the NEP, which began in the year 1971 and ended in the year 1990. Until the year 2010, big cities such as Kota Setar, Kulim, Sungai Petani, Ipoh, Seberang Perai, Georgetown, Kuala Lumpur, Petaling Jaya, Klang, Seremban, Johor Bharu, and Pasir Gudang started to emerge. The provision of many employment opportunities from ample angles in both the public and private sectors in the big cities enabled the various races to fill jobs and live in urban areas.

For the Malays, job prospects coupled with the support of housing loans from the government to allow public sector workers to buy houses in urban areas had encouraged them to migrate to the cities. In addition, the remarkable progress in education made through the implementation of the NEP had also enabled the Malays to compete with the other races in the challenging urban environments. Previously under British rule, the educational opportunities given to the Malays were limited. With the establishment of the NEP, the majority of the Malays received help from Jabatan Pertahanan Awam (JPA) and Majlis Amanah Rakyat (MARA) to further studies. With that, the Malays children got a chance to develop themselves and engage in business activities. The outcome encouraged the Malays to migrate to the urban areas and live together with other races. While, the Chinese, who was long been known as traders also migrated to the cities. Thus, areas with large populations coupled with encouraging economic growth had influenced them to migrate to new areas and live with other races. As for the Indians, the closure of many estate areas had forced them to migrate to new areas and stay mixed with other races.

Furthermore, Tarmiji et al. (2012) identified that West Coast States (Perlis, Kedah, Pulau Pinang, Perak, and Selangor) experienced higher urban population growth compared to the other states between the years 1991-2000. People from various areas, regardless the race competed to secure places in those developed areas (Mohd Faris et al., 2016). Hence, leaving sub-urban areas with the unbalanced composition of race. In relation, the presentation of tables and maps in this research paper has helped to explain that the segregation level on the West Coast States was

generally low because the mixture of people rooted from different origins, ethnicities, and races in the high population helped to balance the composition.

Conclusion

All things considered, it can be concluded that during the period of 40 years (1980-2010), they were districts in peninsular Malaysia that experienced increment and reduction in segregation measure. Also, some districts underwent unchanged segregation levels. By way of conclusion, generally, the magnitude of Entropy Index (H) for the racial segregation in peninsular Malaysia from the year 1980 until 2010 were at a medium level. The geo-visualization by the maps clearly shows that the high and medium-high segregation index of most districts on the West Coast were balanced by the medium-low and low index of most districts on the East Coast. Hence, the big differences of value from two (2) opposite wide localities had produced the medium mean of segregation.

The low segregation level in the majority of areas on the West Coast showed that the intense urbanization gave no negative effects for the Malay, Chinese, Indian, and Others to live in. Instead, the urbanization that took place has brought in many job opportunities for multi-racial people. This result has supported the fact that why urban areas hold high density and concentration of people compared to the sub-urban areas. On the opposite, it explains the reason why the rural areas were left with an unbalanced composition of races. In other words, the physical development in rural areas was not intense as in the cities. This study has provided strong evidence that different levels of physical development bring different effects to social growth. Leapfrog development explained the high segregation level in the rural areas.

Therefore, Malaysia Government should pay attention to both; the physical growth of all districts and federal territories as well as the social development among races in peninsular Malaysia in order to accelerate the social integration among populations of different races in all localities. For future plan, it is hoped that the development policies and strategies carried out by the Malaysia Government will have a positive impact in lowering the racial segregation index so that the goals and vision of the government for creating a united society will be achieved successfully.

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