

Changes in the Socio-Spatial Structure in the Tokyo Metropolitan Area: Social Area Analysis of Changes from 1990 to 2010*

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The purpose of this research is to conduct a socio-spatial analysis on data from 1990, 2000, and 2010 using identical indices with the Tokyo Metropolitan area, spread over 4 prefectures and 1 city of Tokyo-to, Kanagawa-ken, Saitama-ken, Chiba-ken, Ibaraki-ken, as the analysis area and to use this to conduct a comparative time-based study. The analysis region was within a diameter of 60 km from the centre of Tokyo Station, and the Basic Grid Square was the unit of analysis and representation. The analysis results indicated that there were 3 types of changes including a) progress of decreasing birthrate and ageing population in almost all regions in the 60km area, b) changes arising in urban cores of polarization into new middle class and working class and accumulation of service jobs, c) changes arising in surrounding areas of accumulation of distribution facilities primarily in manufacturing.

Keywords: socio-spatial structure, Tokyo metropolis, social area analysis, gentrification, segregation, social atlas

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Introduction

Socio-spatial analysis of the Tokyo metropolis

The purpose of this research is to conduct a comparative time-based analysis of the socio-spatial structure of the Tokyo Metropolitan area, spread over 4 prefectures and 1 city of Tokyo-to, Kanagawa-ken, Saitama-ken, Chiba-ken, Ibaraki-ken. When we compare Tokyo to New York, London, Paris, and other world cities, “Tokyo” does not only refer to the city of Tokyo proper. The “Tokyo” society is structured by the activities of people working in Marunouchi on weekdays, who live in Kanagawa-ken and Saitama-ken. Disneyland, which is in Maihama, Urayasu, Chiba-ken, and is called Tokyo Disneyland, is said to be one of the travel destinations of “Tokyo.” This “Tokyo” that extends beyond the City of Tokyo is referred to as the Tokyo Metropolitan Area in this research.

Research on the socio-spatial structure of the Tokyo Metropolitan Area has a long history and the first analysis was conducted by a first-generation Japanese urban sociologist, Isomura Eiichi. Isomura (1953, pp. 88-89) analyzed the changes in population distribution in Tokyo from 1905 until 1950 by plotting distance from the Tokyo core on the x-axis and population density on the y-axis. The eastern end of the analysis area was Edogawa and the western Kanazawa-ku, Yokohama-shi, so the area of analysis extended beyond the City of Tokyo as the administrative class. Based on this graph, it is apparent that population moved from the civic centre region destroyed by the Great Kanto Earthquake (1923) to Yokohama and that the war in the 1940s led to a sharp decline in population in the civic centre region, but population quickly recovered after the war.

Social area analysis and social atlas

Kurasawa Susumu (1986), a second-generation Japanese urban sociologist used data from 1970 until 1975 and published the “Tokyo no shakai chizu [Social Atlas of Tokyo]”. The representation unit was the quaternary mesh, which is one quarter of a Basic Grid Square (tertiary mesh) used in the Grid Square Statistics, with an area of approximately 500 meters per side and the analysis region was only the 23 wards of the City of Tokyo. A thematic map of over 100 lobes was published and the social areas comprising 20 social areas found by social area analysis is shown in the foreword. The following 3 points

are the main findings. (1) The civic centre region was composed of the central business district and new residential areas are located in the 23-ward margin. Filling in this gap are residential areas, forming a concentric ring structure in land use, (2) similarly in terms of the age composition of the population, older people tended to live in downtown areas, while younger people tended to reside in suburban areas, with a concentric circle distribution. (3) In contrast, from the viewpoint of residential distribution by social class distinction, the western/south-western side of 23 districts was high class, while the eastern/north-eastern side was low class, indicating a sector-type.

Subsequently, Kurasawa and Asakawa (2004) used data from 1975 and 1990 to publish the “Shinpen Tokyoken no shakai chizu [New Social Atlas of Tokyo 1975-1990]”. In this research, the analysis range was expanded to 1 city and 4 prefectures (Tokyo-to, Kanagawa-ken, Saitama-ken, Chiba-ken, and Southern Ibaraki-ken). Also, the representative unit was the quaternary mesh for the 23 wards of Tokyo-to and the municipality for the Tokyo Metropolitan Area extending over 1 city and 4 prefectures. By expanding the scope of analysis, it became apparent that the (1) low-class regions observed in the eastern/north-eastern side of the 23 wards was founded in the blue collar belt extending north along Saitama-ken and Chiba-ken, (2) the social changes of post-industrialization and globalization that have occurred after 1980 have destroyed the manufacturers and small factories that existed in the eastern/north-eastern side of the 23 wards and the region from Ota-ku to Kawasaki-shi, moving them to the suburbs and overseas, while manufacturers concentrated from Southern Ibaraki-ken to Saitama-ken, (3) a homogeneous concentric circle structure developed in each zone from the core in the Tokyo Metropolitan Area as a whole.

Post-bubble socio-spatial structure

Research using data from 1990 and later is found in Asakawa (2006). Asakawa used data from 1990 and 2000 and analyzed the Southern Kanto region. The representative unit was standard grid mesh (tertiary mesh, approximately 1km per side). Principal component analysis was used to discriminate the city region and agricultural regions from the Southern Kanto region. The former was subjected to social area analysis as “Tokyo Metropolis” for 1990 and 2000. The analysis results indicated that (1) the blue collar belt distinctly observed from 1975 through 1990 was eroded by the white collar layers and losing its characteristics, (2) the inflow into the upper

white collar suburban region (suburbanization) observed in 1990 was on the decline, (3) the direction of the definition of the concentric circle structure of the entire Tokyo Metropolis observed in Tokyo up to 1990 progressed further, etc.

Also, Asakawa (2014) used data from 2000, 2005, and 2010 to analyze the 1 city and 4 prefectures and used standard mesh as the representative unit in analysis. The results indicated that (1) up to 2005, population increases were observed across nearly all 4 prefectures and the 1 city, (2) after 2005, regions with population growth and regions with population decline split up and the former was relatively restricted to the core 23 wards of Tokyo, (3) however, regions with population growth were observed along the Tsukuba Express line.

Cross-sectional analysis and longitudinal analysis

As observed up to this point, the socio-spatial structure analysis in the preceding research emphasized annual cross-sectional analyses. The purpose of the research was to clarify the socio-spatial structure of the Tokyo Metropolis in each year and to clarify the causes of that structure. In order to do that, indices used in social area analysis were selected for analysis for each year and the same index was not necessarily used in all cases.

With some cross-sectional research accumulated at this point, diachronic comparative studies are now possible. As such, in this research, the Tokyo Metropolis was used as the analysis range and data from 1990, 2000, and 2010 was subjected to social area analysis in order to conduct a comparative sequential analysis.

Method

Data and analysis range

In this research, 1990, 2000, 2010¹ national census data was purchased and used in analysis. The analysis and representation unit was the Basic Grid Square (tertiary mesh) used in the Grid Square Statistics with approximately 1km per side. The Grid Square Statistics is the “organization of statistical data

¹ As of October 2016, the most recent national census was conducted in 2015. Nevertheless, the data for that has yet to be published.

related to each region done by dividing an area into a grid (mesh) based on latitude and longitude without any gaps.”² National census data corresponding to the Primary Area Partition covering the entire Tokyo Metropolis region was purchased and used with the Basic Grid Square as the unit of analysis and representation.

The analysis range was within a 60 km radius with Tokyo Station at the centre and this will be referred to as the Tokyo Metropolis. The railroad transportation network in Tokyo Metropolis is developed and the centre is Tokyo Station, so Tokyo Station was treated as the cardinal point. From the cardinal point, regions beyond 60 km were treated as outside the analysis range due to scattered agricultural regions that do not share the socio-spatial structure of the Tokyo Metropolis.

Indices

Japan’s population census includes multidisciplinary indices, including population/family structure, industrial structure, education³, population influx, residence type, social class and profession, work/school commute structure, etc. In order to select indices to use in analysis, first, all calculable indices were created and a thematic map plotted. In this process, a decision was made to exclude from analysis indices with markedly uneven distributions such as the foreigner population ratio, etc. Also, with indices that are strongly correlated to one another⁴, such as the proportion of older senior citizens, proportion of senior couple-only households and proportion of single senior households, only one of such indices was used for analysis.

With these selection processes, 14 indices representing each field were used in analysis: “proportion of population aged 5 years and under,” “proportion of older senior citizens,” “unemployment rate,” “proportion of temporary industry workers⁵,” “proportion of secondary industry workers,” “proportion of tertiary industry workers,” “proportion of university graduates,” “proportion of incoming population (proportion of population in residence for under 5 years),” “proportion of homeowners,” “proportion of

² Statistics Bureau of the Ministry of International Affairs and Communications, Retrieved October 14, 2016 (http://www.stat.go.jp/data/mesh/m_tuite.htm).

³ Academic background is only surveyed in the large survey conducted every 10 years.

⁴ $r > 0.7$ was considered a strong correlation.

⁵ The 2000 data did not use consistent indices, so “casual employment” was used as an approximation. Also, there wasn’t a corresponding index in the 1990 data, so a corresponding index was not used.

managerial jobs,” “proportion of service jobs,” “proportion of commuters for work and school between districts and wards of the same city,” “proportion of commuters for work and school between cities, wards, and districts within the same prefecture,” and “proportion of commuters for work and school between prefectures.”

Analysis method

(1) Thematic map analysis

The analysis methods used in this research were (1) analysis using the thematic map, (2) social area analysis, (3) service industry worker reclassification. The purpose of this research was to analyze the changes from 1990 to 2010, so for thematic map analysis, 1990 was used as the reference year and the value for each class in the reference was used to conduct the 2000 and 2010 class divisions. Also, class divisions in the reference year were classified into 6 ranks using the mean, mean \pm 1/2 standard deviation, and mean \pm standard deviation.

(2) Social area analysis

Cluster analysis using the K-means method was used to conduct a social area analysis. In Kurasawa and Asakawa (2004), the KS method was used for cluster analysis. Cluster analysis by the KS method has the property of being able to find only one optimal solution in cross-sectional analysis. As such, it is possible to find the optimal solution for each year. Nevertheless, it was not suited for the purpose of this research, which was to conduct time-series comparisons using the same criteria. On the other hand, with K-means analytical method, the analyst prescribes the number of clusters to be found. This method was optimal for making comparisons over time for each year of 1990, 2000, and 2010, with the consistent criterion of “detecting the same number of clusters”.

For the number of clusters to be found, 1990 data was used and 2 clusters to 12 clusters were specified, which resulted in the optimal solution being found with 9 clusters, so 9 was used.

(3) Reclassification of service industry workers

For service industry worker reclassification, only the 2010 population census data was used. Industries that were lumped together as the “service industries” up to 2000 were substantially revised starting in the 2010 data and more specific broad categories such as the “telecommunications industry,”

“restaurant/hospitality industries,” etc. are now being used. This was a reform that corresponded with the large increases in service industry workers with the changes in industrial structure in Japanese society that occurred after 2000.

As such, service industry workers were separated into (a) financial business/information business and other occupations requiring high levels of skill or judgement and (b) those responsible for only simple work in those occupations and those workers responsible for supporting occupations requiring high levels of skill/judgement. In this research, the former is referred to as “new middle class” and the latter as “working class.” Specifically, those working in the “electric/gas/heat supply/water industries,” “telecommunications industry,” “finance/insurance industries,” “real estate/lease industries,” “academic research/specialized/technical service industries,” “training/learning support industries,” “public services” were classified as the new middle class and those working in the “transportation/mail service industries,” “wholesale/retail industries” “hospitality/food service industries,” “lifestyle-related service/entertainment industries” were classified as “working class.”⁶

Results

Thematic map analysis

For all 14 indices used in this research, thematic maps for 1990, 2000, and 2010 were created. When thematic maps were compared over time for each index, 3 types of patterns of change were observed, including (a) pattern of increase/decrease of high-proportion regions within a 60 km radius,⁷ (b) pattern of segregation of specific regions with high proportions,⁸ and (c) pattern of no apparent changes in distribution.⁹

⁶ Also, “medical and welfare” were not included in the working class or the new middle class due to the fact that the medical industry and nursing industry could not be separated.

⁷ Indices that showed this pattern of change were, proportion of older senior citizens, proportion of population aged 5 years and under, unemployment rate, proportion of service workers, proportion of commuters for work and school between districts and wards of the same city, proportion of commuters for work and school between cities, wards, and districts within the same prefecture, and proportion of incoming population.

⁸ Indices that showed this pattern of change were proportion of secondary industry workers and proportion of university graduates.

⁹ Indices that showed this pattern of change were proportion of homeowners, proportion of

First, thematic maps were made for proportion of older senior citizens and proportion of service industry workers as indices in which type (a) changes were observed. The changes in the proportion of older senior citizens (population aged 75 years and over/total population) over time are shown in Fig. 1A to 1C. In 1990, regions with high rates were observed in the city core and surrounding areas. After that, over time, increases in proportion were observed in all regions within a 60 km radius. The changes in the proportion of service industry workers (number of services workers/number of workers aged 15 years and over) are shown in Fig. 2A to 2C. In 1990, regions with high rates were concentrated in the core of Tokyo's 23 districts. After that, all regions within a 60 km radius had high rates.

Next, the proportion of secondary industry workers and university graduates, the index in which type (b) changes were observed, is graphically illustrated. The changes in the proportion of secondary industry workers (number of secondary industry workers/number of workers aged 15 years and over) is shown in Fig. 3A to 3C. In 1990, regions with high proportions

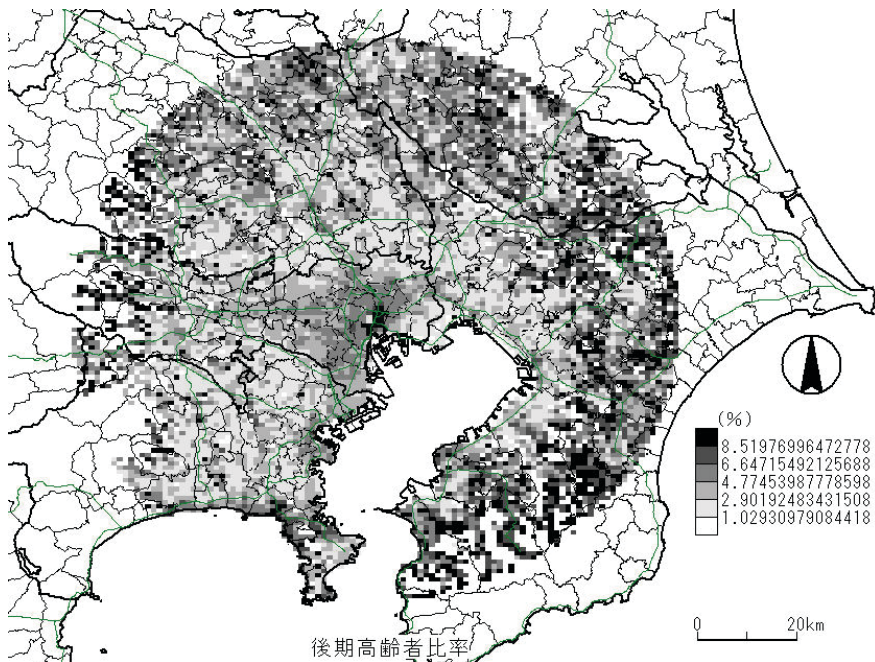


FIG. 1A.—Proportion of Older Senior Citizens 1990

commuters for work and school between prefectures, and proportion of managerial jobs.

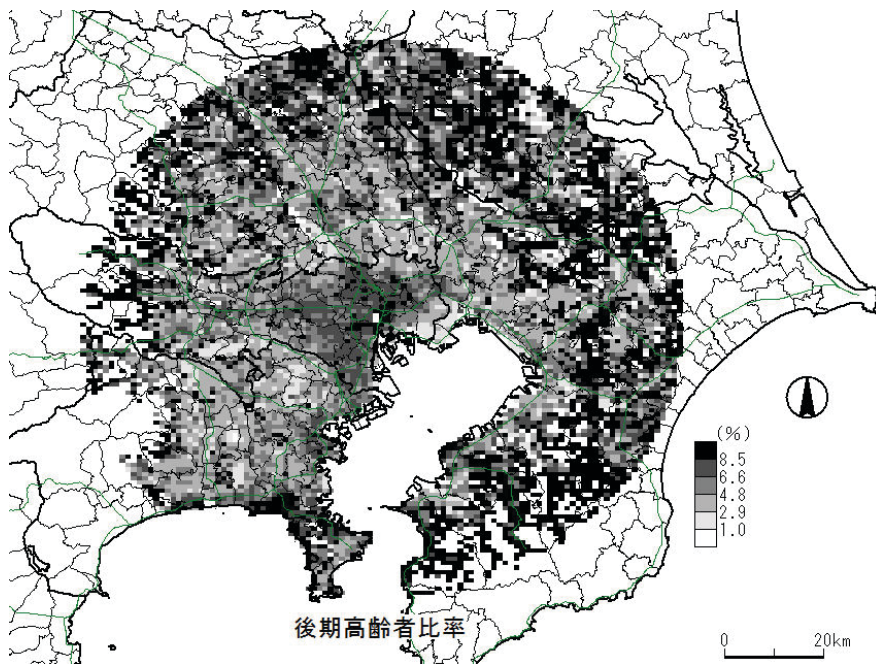


FIG. 1B.—Proportion of Older Senior Citizens 2000

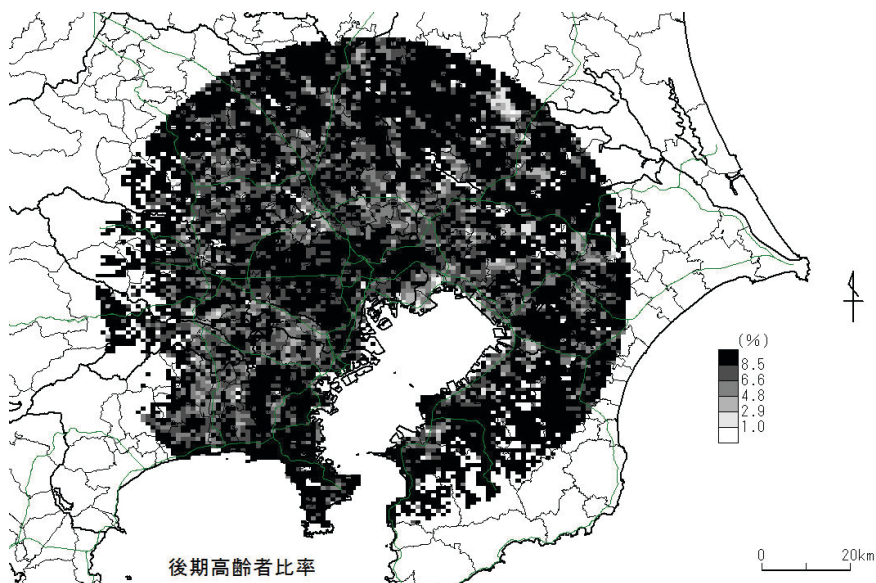


FIG. 1C.—Proportion of Older Senior Citizens 2010

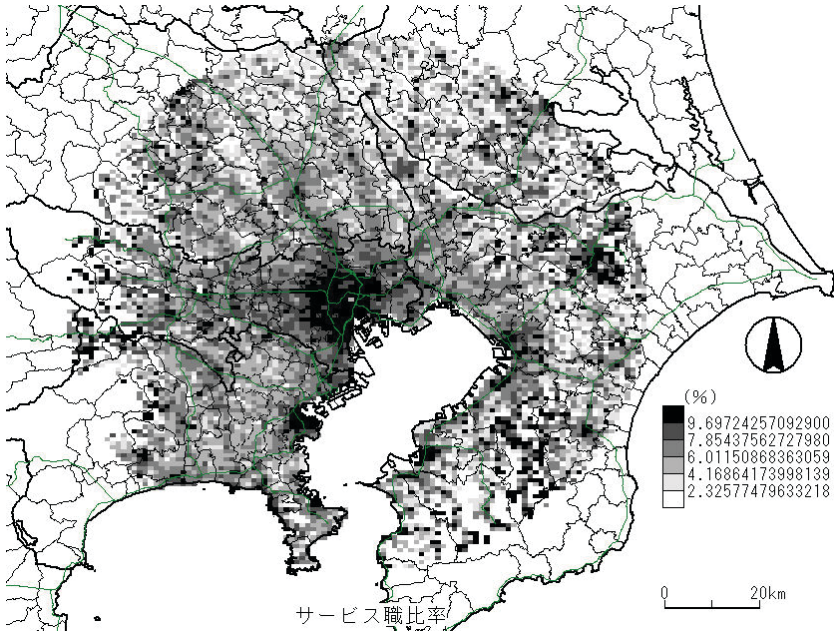


FIG. 2A.-Service Job Employee Proportion 1990

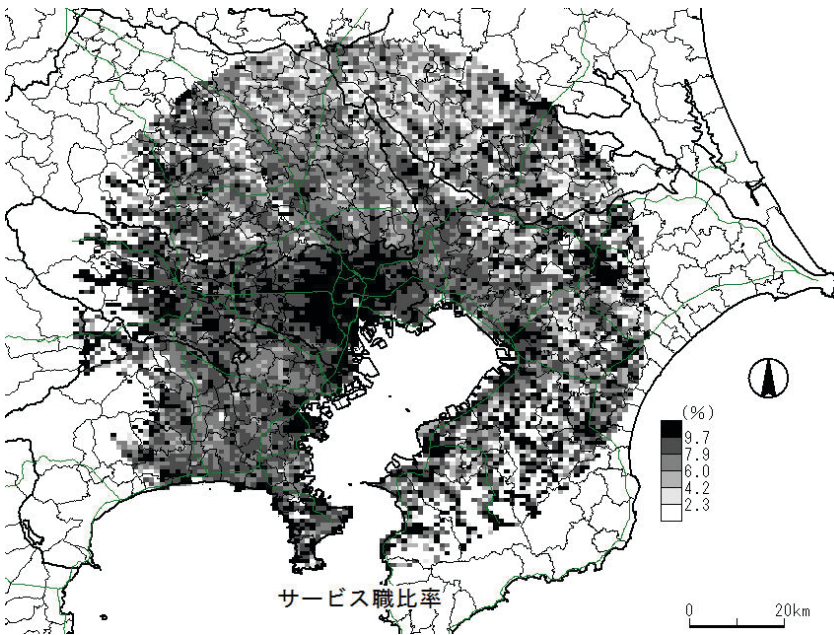


FIG. 2B.—Service Job Employee Proportion 2000

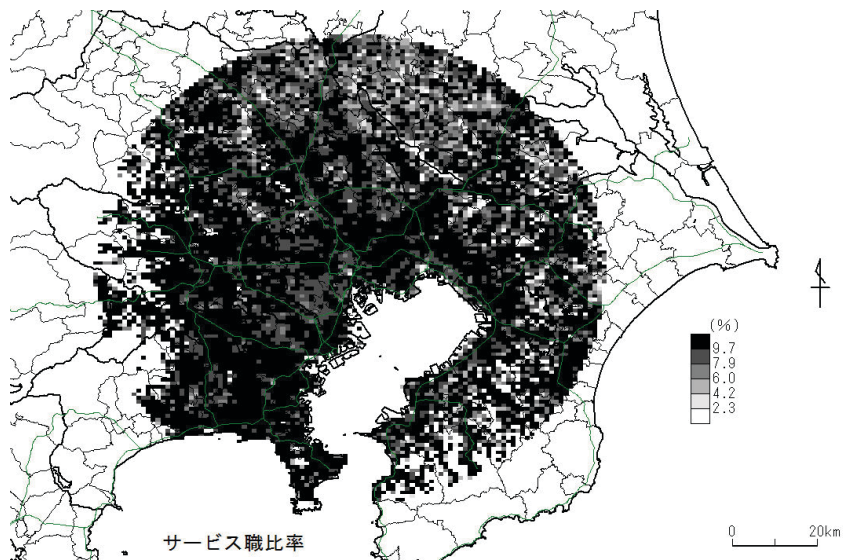


FIG. 2C.—Service Job Employee Proportion 2010

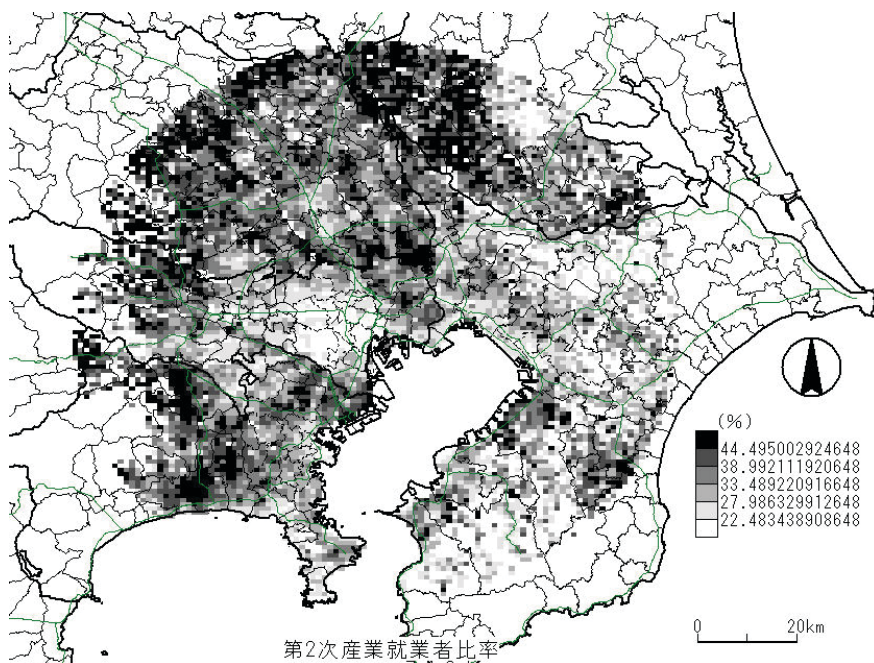


FIG. 3A.—Secondary Industry Employee Proportion 1990

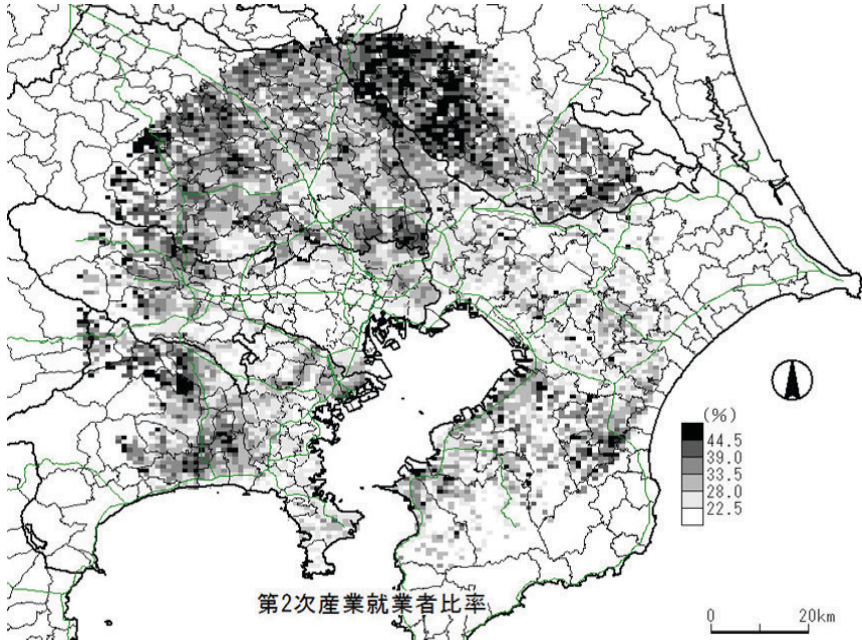


FIG. 3B.—Secondary Industry Employee Proportion 2000

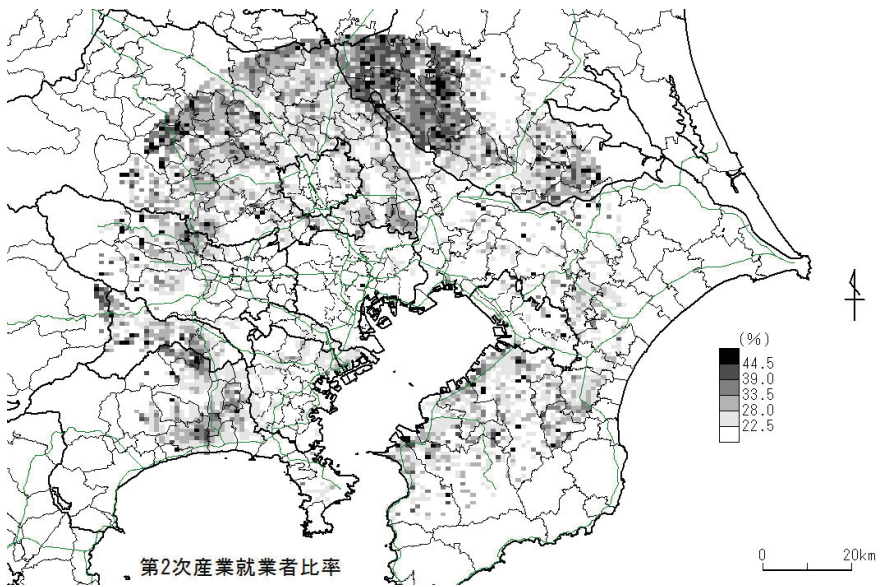


FIG. 3C.—Secondary Industry Employee Proportion 2010

were observed in the eastern districts of the 23 wards of Tokyo, from Southern Ota-ku to Kawasaki-shi, in central Kanagawa-ken, in Saitama-ken and Ibaraki-ken, and Ichihara-shi, Chiba-ken. In 2000, proportions fell in all regions. Large drops were specifically observed in the eastern districts of the 23 wards of Tokyo and from Southern Ota-ku to Kawasaki-shi. In 2010, regions with high proportions were segregated in Southern Ibaraki-ken.

Changes in the proportion of university graduates over time are shown in Fig. 4A to 4C. In 1990, regions with high proportion extended in the western districts of the 23 wards of Tokyo and to the suburbs through major roads, such as the national 246 extending from there, as well rail lines such as the Odakyu line, Keio line, JR Chuo line, and the Tohoku line. Also, regions with high proportions were observed in coastal Chiba-shi to Kashiwa-shi in Chiba-ken and concentrated in Tsukuba-shi in Ibaraki-ken. In 2000 and 2010, concentrations on major roads and rail lines increased. On the other hand, regions with low proportions of university graduates extending from the eastern districts of the 23 wards of Tokyo and along the boundaries of Saitama-ken and Chiba-ken continued to exist from 1990 to 2010.

Finally, thematic maps of high proportions of homeowners (number of homeowner/ number of households) from indices in which (c) changes were

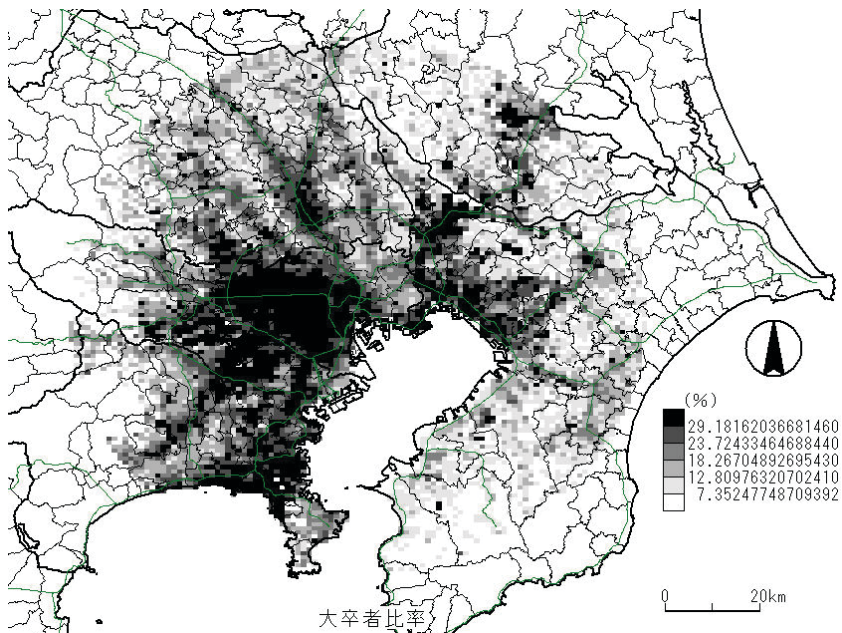


FIG. 4A.—University Graduate Proportion 1990

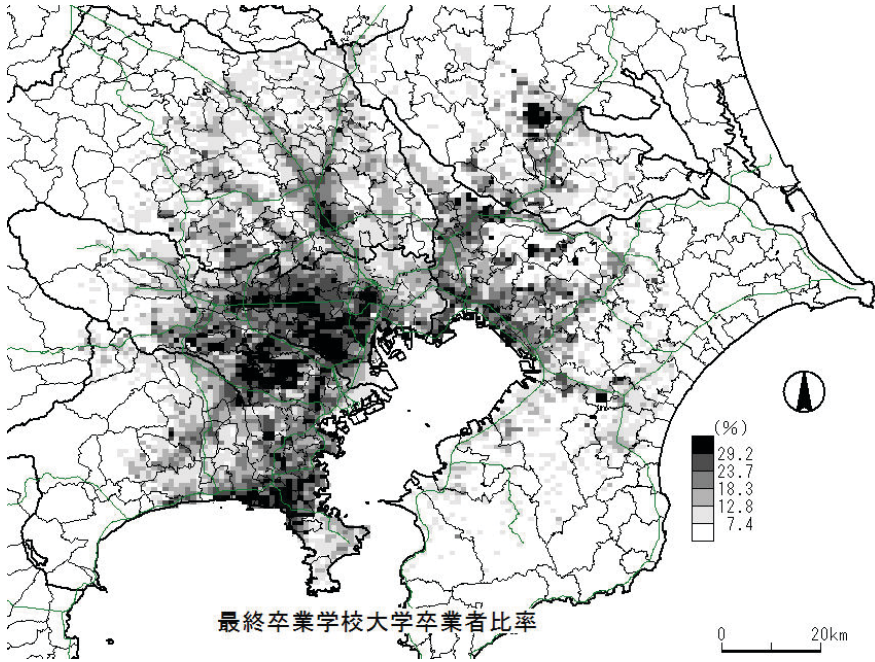


FIG. 4B.—University Graduate Proportion 2000

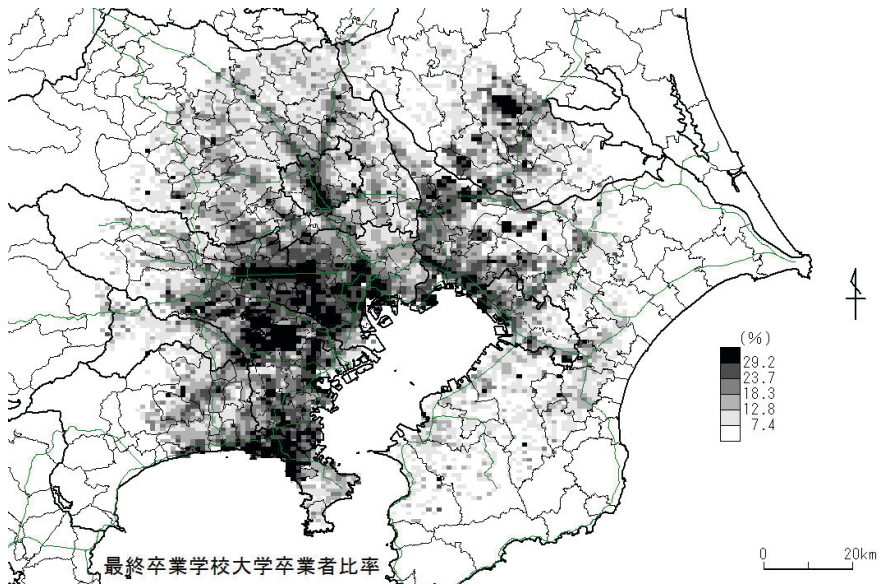


FIG. 4C.—University Graduate Proportion 2010

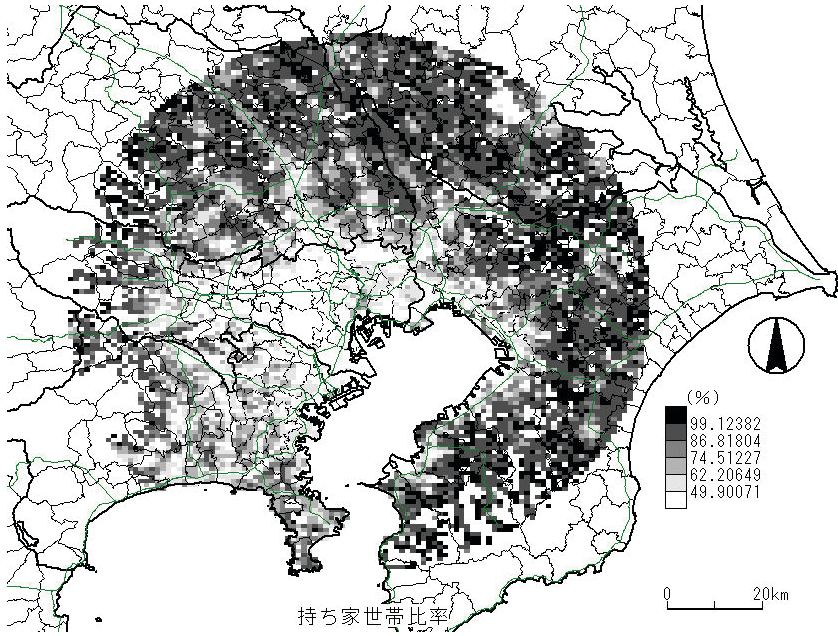


FIG. 5A.—Own Household Proportion 1990

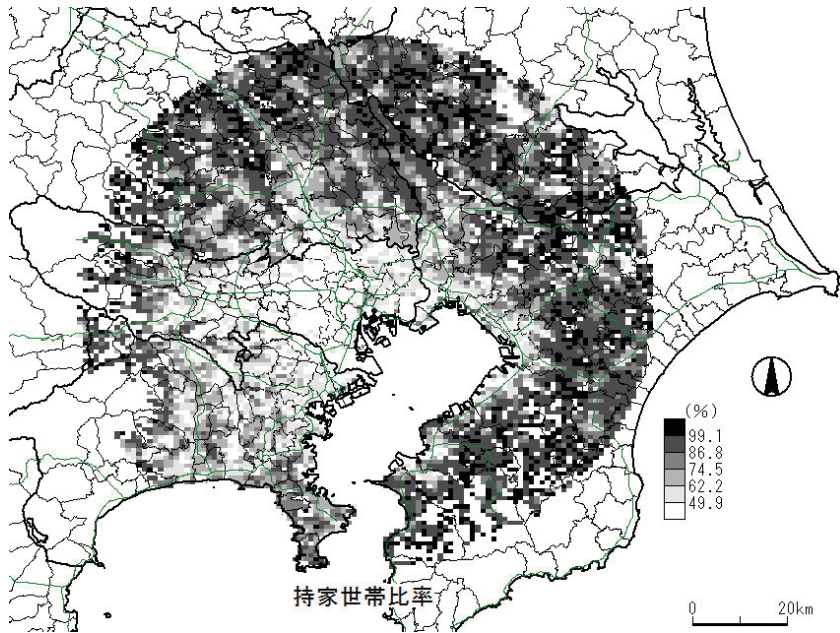


FIG. 5B.—Own Household Proportion 2000

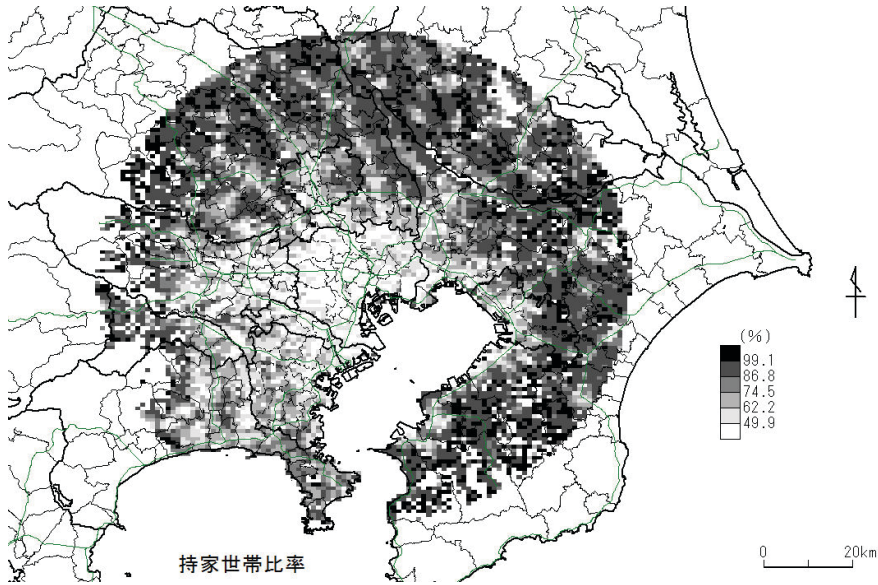


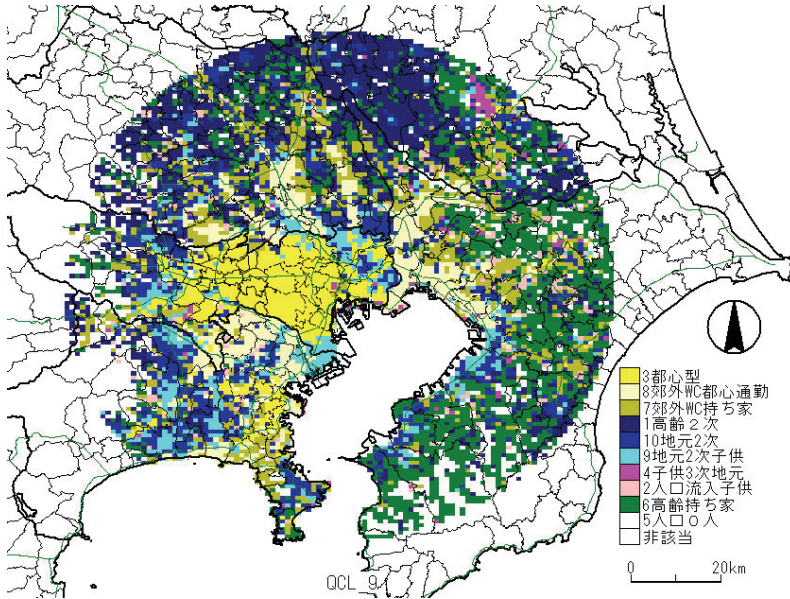
FIG. 5C.—Own Household Proportion 2010

observed is shown in Fig. 5A to 5C. For the proportion of homeowners, few changes in distribution were observed over time.

Social area analysis

The social areas found by cluster analysis by the K-means method are shown in Fig. 6A to 6C. A table summarizing the characteristics of each social area is shown under the thematic map depicting the social areas for each year (hereinafter referred to as the social atlas). The indices shown in those tables are those with the highest 3 means of the social area. In other words, in the characteristics of the social area of 1990 (Fig 6A), unemployment rate was listed as a characteristic of 3 social areas, including “city core type” “suburban white-collar downtown commuting” and “local secondary children.” This means that for these 3 social areas, the mean unemployment rate was in the top 3 places.

The social area of 1990 (Fig. 6A) was comprised of 9 social areas, including “city core type,” “suburban white collar commuters to the city core,” “suburban white collar homeowners,” “elderly secondary,” “local secondary,” “local secondary children,” “children tertiary local,” “population influx children,” “senior homeowners.” The “city core type” was seen in the western



Social area characteristics

City core type	Unemployment rate, proportion of tertiary industry employees, proportion of university graduates, proportion of managerial jobs, proportion of service jobs, proportion of commuters for work and school between cities, wards, and districts within the same prefecture
Suburban WC urban core commuters	Proportion of population aged 5 years and under, unemployment rate, proportion of tertiary industry workers, proportion of university graduates, proportion of incoming population, proportion of managerial jobs, proportion of commuters for work and school between prefectures
Suburban WC homeowners	Proportion of home owning households, proportion of managerial jobs, proportion of commuters for work and school between cities, wards, and districts in the same prefecture, proportion of commuters for work and school between prefectures
Elderly secondary	Proportion of late-stage elderly, proportion of secondary industry workers, proportion of home owning households
Local secondary	Proportion of secondary industry workers, proportion of commuters for work and school between districts and wards in the same city, proportion of commuters for work and school between different cities, wards, and districts in the same prefecture
Local secondary children	Unemployment rate, proportion of secondary industry workers, proportion of service jobs, proportion of commuters for work and school between different wards and districts in the same city
Children tertiary local	Proportion of population aged 5 years and under, proportion of tertiary industry workers, proportion of incoming population, proportion of service jobs, proportion of commuters for work and school between different wards and districts of the same city
Population influx children	Proportion of population aged 5 years and under, proportion of older senior citizens, proportion of university graduates, proportion of incoming population, proportion of commuters for work and school between prefectures
Elderly homeowners	Proportion of older senior citizens, proportion of homeowners

FIG. 6A.—1990 Social Map

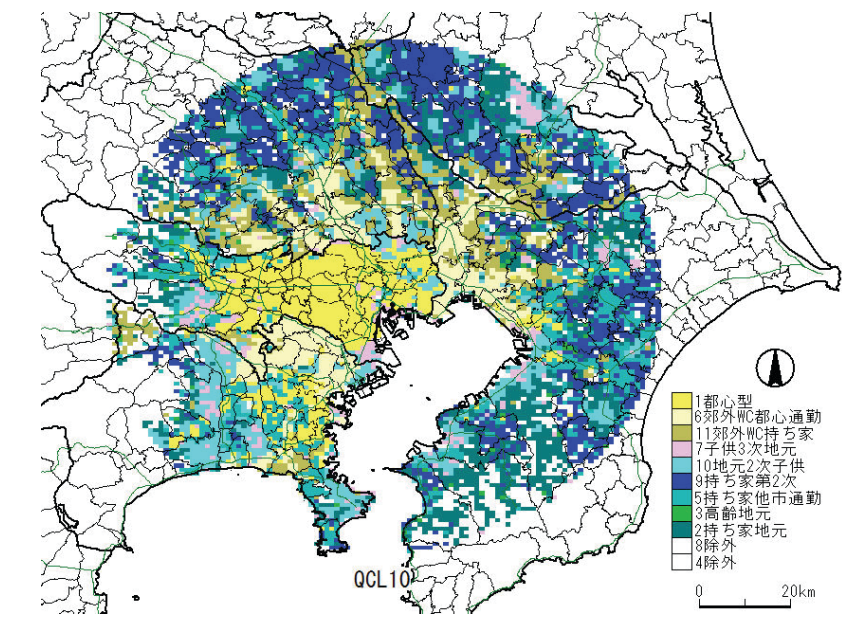
part of the 23 wards of Tokyo and Yokohama-shi, Kanagawa-ken. The “suburban white collar commuters to the city core” extended from the city core along major roads and railways to the suburbs and “suburban white collar homeowners” were observed in places somewhat removed from major roads and railways. “Local secondary” and “local secondary children” were distributed from the eastern 23 wards of Tokyo and Ota-ku through Kawasaki-shi in Kanagawa-ken.

When looking at the surrounding areas, “elderly secondary” was broadly distributed from Southern Ibaraki-ken across Saitama-ken, Western Tokyo-to, and central Kanagawa-ken. As for Chiba-ken, “suburban white collar commuters to the city core” were observed primarily in Chiba-shi and “local secondary children” were distributed primarily in coastal Ichihara-shi, while the remainder was largely accounted for by “elderly homeowners.”

Fig. 6B shows the social atlas of 2000. The social atlas of 2000 comprised 9 social areas, including “city core type,” “suburban white collar commuters to the city core,” “suburban white collar homeowners,” “children tertiary local,” “secondary local children,” “homeowners secondary,” “homeowners who commuted to other cities,” “elderly locals,” “homeowners local.” Although the “city core type” was seen in the western part of the 23 wards of Tokyo and Yokohama-shi, Kanagawa-ken as in 1990, a large change was that the “city core type” accounted for most of the eastern part of the 23 wards of Tokyo. As for the surrounding areas, “homeowners secondary” were observed in Southern Ibaraki-ken and Northern Saitama-ken, but not in Western Tokyo or central Kanagawa-ken. Except for the coastal areas, they were becoming broadly distributed in Chiba-ken.

The social atlas of 2010 (Fig. 6C) comprised 9 social areas, including “city core type,” “suburban white collar commuters to the city core,” “suburban white collar homeowners,” “children secondary and tertiary,” “local secondary children,” “homeowners secondary,” “homeowner commuters to other cities,” “elderly local population influx,” and “homeowners local.” Almost all areas were accounted for by the “city core type,” including the eastern 23 wards of Tokyo. “Homeowners secondary” were mostly segregated in Southern Ibaraki-ken. “Homeowner commuters from other cities” were broadly distributed from Northern Saitama-ken to Western Tokyo-to and through central Kanagawa-ken. Except for the coastal areas, Chiba-ken also was represented largely by “homeowner commuters to other cities.”

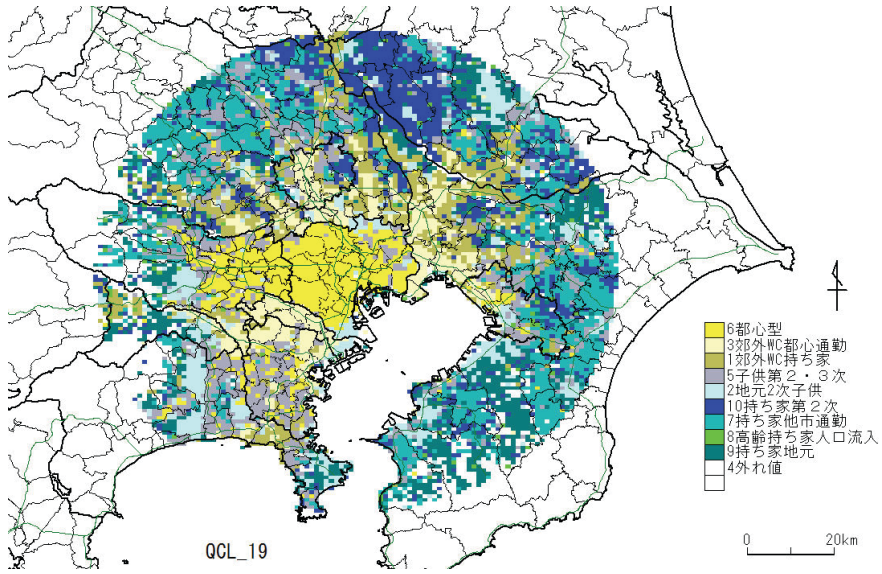
The socio-spatial structure changes from 1990 to 2010 shown in these 3 social atlases can be summarized in 3 points. (1) For the city core, the base of



Social area characteristics

City core type	Unemployment rate, proportion of tertiary industry employees, proportion of university graduates, proportion of managerial jobs, proportion of service jobs, proportion of commuters for work and school between cities, wards, and districts within the same prefecture
Suburban WC urban core commuters	Proportion of population aged 5 years and under, proportion of tertiary industry workers, proportion of university graduates, proportion of incoming population, proportion of managerial jobs, proportion of commuters for work and school between prefectures.
Suburban WC homeowners	Proportion of casual workers, proportion of managerial jobs, proportion of commuters for work and school between prefectures.
Children tertiary local	Proportion of population aged 5 years and under, proportion of casual workers, proportion of tertiary industry workers, proportion of university graduates, proportion of incoming population, proportion of service jobs, proportion of commuters for work and school between districts and wards of the same city
Local secondary children	Proportion of population aged 5 years and under, unemployment rate, proportion of secondary industry workers, proportion of commuters for work and school between different wards and districts in the same city
Homeowners secondary	Proportion of older senior citizens, proportion of secondary industry workers, proportion of homeowners, proportion of commuters for work and school between different cities, wards, and districts in the same prefecture
Homeowner commuters to other cities	Unemployment rate, proportion of commuters for work and school between different wards, districts, and cities in the same prefecture, proportion of commuters for work and school between prefectures
Local elderly	Proportion of older senior citizens, proportion of casual workers, proportion of incoming population, proportion of homeowners, proportion of service jobs
Homeowner locals	Proportion of older senior citizens, proportion of secondary industry workers, proportion of homeowners, proportion of commuters for work and school between different wards and districts in the same city

FIG. 6B.—2000 Social Map



Social area characteristics

City core type	Proportion of temporary workers, proportion of tertiary industry employees, proportion of university graduates, proportion of managerial jobs, proportion of commuters for work and school between cities, wards, and districts within the same prefecture
Suburban WC urban core commuters	Proportion of population aged 5 years and under, proportion of temporary workers, proportion of tertiary industry workers, proportion of university graduates, proportion of incoming population, proportion of managerial jobs, proportion of commuters for work and school between prefectures
Suburban WC homeowners	Unemployment rate, proportion of tertiary industry workers, proportion of university graduates, proportion of managerial jobs, proportion of commuters for work and school between prefectures
Children secondary and tertiary	Proportion of population aged 5 years and under, unemployment rate, proportion of service jobs, proportion of commuters for work and school between different cities, wards, and districts in same prefecture, proportion of commuters for work and school between prefectures
Local secondary children	Proportion of population aged 5 years and under, proportion of temporary workers, proportion of incoming population, proportion of service jobs, proportion of commuters for work and school between different wards and districts in the same city
Homeowners secondary	Proportion of late-stage elderly, proportion of secondary industry workers, proportion of home owning households
Homeowner commuters to other cities	Unemployment rate, proportion of secondary industry workers, proportion of homeowners, proportion of commuters for work and school between different wards, districts, and cities in the same prefecture
Elderly local population influx	Proportion of older senior citizens, proportion of secondary industry jobs, proportion of incoming population, proportion of homeowners, proportion of commuters for work and school between different districts and wards of the same city
Homeowner locals	Proportion of older senior citizens, proportion of service jobs, proportion of commuters for work and school between different wards and districts in the same city

FIG. 6C.—2010 Social Map

the blue collar belt in the eastern 23 wards of Tokyo was replaced by the city core type. Also, (2) the blue collar region that spread from Ota-ku through Kawasaki-shi was also replaced by the city core type. (3) The manufacturing industries that were once largely concentrated in the surrounding areas became segregated in Southern Ibaraki-ken, Chiba-ken, Saitama-ken and central Kanagawa-ken changed to concentrations of other industries.

Reclassification of service industry workers

The results of social area analysis indicated that the base of the blue collar belt that existed in the eastern 23 wards of Tokyo disappeared. However, as shown by the proportion of university graduates (Fig. 4), throughout the period from 1990 to 2010, regions in which the proportion was low were found in the eastern 23 wards of Tokyo and extended north from there along the prefecture boundaries of Saitama-ken and Chiba-ken. These 2 finds seem to contradict each other.

Thus, as mentioned above, upon re-classifying service industry workers into the new middle class and working class, a thematic map was created. Fig. 7A is a thematic map of the new middle class and showed a distribution similar to the proportion of university graduates. In other words, regions with high proportions were observed in the western districts of the 23 wards of Tokyo and to the suburbs through major roads, such as the national 246 extending from there, as well rail lines such as the Odakyu line, Keio line, JR Chuo line, and the Tohoku line. On the other hand, the eastern districts of the 23 wards of Tokyo and regions extending northward along the prefecture boundaries from there to Saitama-ken and Chiba-ken were regions with low proportions. In contrast, the thematic map of the working class (Fig. 7B) showed that regions with high proportions were based in the eastern part of the 23 wards of Tokyo and extended northward along the prefecture boundaries of Saitama-ken and Chiba-ken.

As shown in Fig. 2, the proportion of service industry workers increased annually in the entire 60 km radius. However, when service industry workers were re-classified into new middle class and working class, the new middle class was segregated to an area within a 60 km radius west from the western 23 wards of Tokyo and from Chiba-shi to Tsukuba-shi on the eastern side within the 60 km radius. Sandwiched between these two areas, the eastern part of the 23 wards of Tokyo as the base and the regions extending from there along Saitama-ken and Chiba-ken showed segregation of the working class.

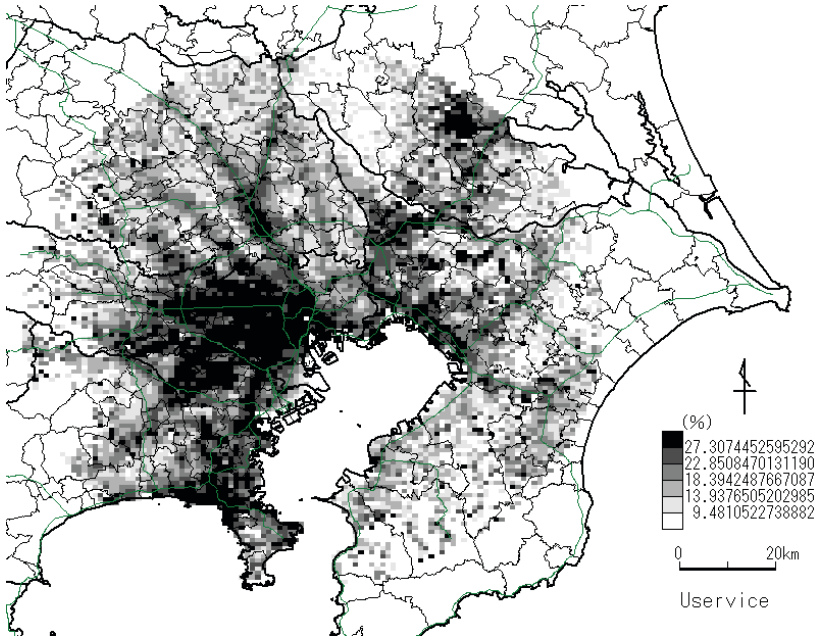


FIG. 7A.—Service Industry Re-Classification: New Middle Class

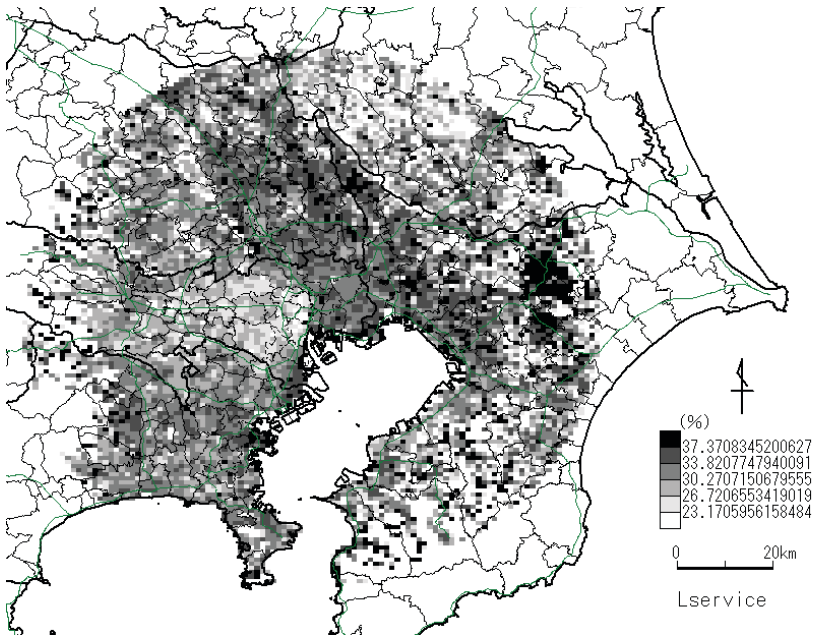


FIG. 7B.—Service Industry Re-Classification: Working Class

Discussion

Trends and theories about socio-regional structure changes

The findings obtained from these analysis results can be organized into the following 3 points. When the Tokyo Metropolitan area is defined as the 60 km radius around Tokyo Station, between 1990 and 2010, 3 types of changes emerged: (a) changes such as progress in declining birthrate and ageing population and increase in unemployment that were happening in all regions in the 60km area to the same extent, (b) changes in urban cores of polarization into new middle class and working class and accumulation of service industry workers, (c) changes in surrounding areas into areas where manufacturing was concentrated and areas of industries other than manufacturing.

The declining birthrate and ageing population is a social trend that is occurring in Japanese society as a whole. As such, the effects of this trend can be considered to be even across all regions of the Tokyo Metropolitan Area. The rise in service industry workers is another social trend in Japanese society as a whole. However, the effects this trend had on socio-spatial changes were not even across regions and regions corresponding to the core of the Tokyo Metropolitan Area. The 23 wards of Tokyo saw 2 types of changes, concentration and differentiation. Eastern areas which had concentrations of blue collar workers up to 1990 changed to residential areas of service industry workers by 2010. However, when service industry workers were re-classified as new middle class and working class, the eastern areas remained working class as before. This suggests that the increase in the number of service industry workers was brought on by the polarization of the area into low-skill/low-income working class and high-skill/high-income new middle class. Manual labourers with middle skill/income levels were, in fact, on the decline. This polarization was also seen in residential differentiation, as the working class concentrated in the eastern region and new middle class in the western region.

For the surrounding areas of the Tokyo Metropolitan Area, while agricultural areas existed mainly in Chiba-ken in 1990, these had changed to manufacturing in 2000. However, by 2010, manufacturing segregated in Southern Ibaraki-ken and Chiba-ken, Saitama-ken, central Kanagawa-ken changed to other industries.

The population census data used in this research could not be analyzed

to determine which kinds of industries manufacturing changed to. However, previous research that looked at location trends in distribution facilities in the 2000s found that “in a total area of 1,600 km² or more, from Chiba around the Tokyo Outer Ring Road and Saitama-ken around the Metropolitan Inter-City Expressway to Tokyo and Kangawa-ken showed prominent sites.” (Hyodo 2016, p.32). The results of this research suggested that recent online shopping prosperity is a factor in the increasing scale of distribution facilities that depend on storage and picking work. These started to concentrate in Chiba-ken, Saitama-ken, and central Kangawa-ken.

Tokyo type gentrification

In Europe and America, there are many reports of the advancement of gentrification in which lower class households are driven out by large-scale redevelopment associated with gentrification (Smith 1996). However, the findings in this research differed from this type of European and American gentrification.

Demographically, those born in the 1930s are called the population at a turning point. This was a generation with a pyramid of high births and high deaths when they were born and most were born into large families. However, when those people grew up and formed their own families, they formed nuclear families and brought the era of a pyramid of low birth rate and low deaths. For this generation, it was typical that eldest sons would succeed the family line and that their siblings would leave towns and move to the Tokyo Metropolitan Area, the Chukyo Metropolitan Area, and Keihanshin Metropolitan Area.

Some of the people who came in became salary men employed at companies and factories in the social changes of industrialization and modernization. At the same time, there were also those who ran their own business. They were called city self-employed class (Tamano 2005). The western parts of the 23 wards of Tokyo developed as residential areas after the Great Kanto Earthquake of 1923 had a large concentration of salary men. On the other hand, manual labourers among the city self-employed class became concentrated in the eastern 23 wards of Tokyo in which there was a concentration of the metalworking industry and manufacturing industry, as well as related industries and from Ota-ku through Kawasaki-shi. Some of those who were self-employed in the city expanded their business through the 1970s and 1980s and hired workers. The social atlas of 1990 shows this kind of Tokyo Metropolitan Area.

However, after that, with their own ageing, many people didn't have their children succeed their businesses and closed them instead. Their children, who were the second generation of the city, did not become city self-employed class, but became incorporated into the new middle class or working class. As such, the city self-employed class started to disappear from statistical data regarding the labour market and class/profession. The social atlas of 2000 shows this kind of Tokyo Metropolitan Area.

After the 1990s, in the core of the Tokyo Metropolitan Area, apartment buildings appeared and relatively cheap apartments were in large supply (Hirayama 2006). The children of the city self-employed class, who were the second generation of the city, and those who came into the city looking for study and employment opportunities from the countryside would have married and had children and moved to the suburbs to find relatively large living spaces. However, this young generation became able to acquire housing close to the city core (Matsumoto 2004). As such, the new middle class residences were created in the eastern districts of the 23 wards of Tokyo. The social atlas of 2010 shows this kind of Tokyo Metropolitan Area.

In this way, the eastern districts of the 23 wards of Tokyo changed from the base of blue collar workers to residences for the new middle class. Looking at the changes in the social class structure, while there was a change to high classes/gentrification, the chasing out of lower-class residences by gentrification as seen in various countries in Europe and America was not observed. Gentrification proceeded in such a way that the city self-employed class retreated from society and instead, the new middle class came to account for a majority of the population. Accordingly, this should be considered as gentrification due to generational changes or temporal difference and should be distinguished from European and American gentrification.

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