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**GEOGRAPHICAL ASPECTS OF RURAL-URBAN INTERACTION**

**PROCEEDINGS  
OF THE ANGLO-POLISH GEOGRAPHICAL SEMINAR  
NOTTINGHAM, SEPTEMRER 1970**

**Edited by  
KAZIMIERZ DZIEWOŃSKI, RICHARD H. OSBORNE AND PIOTR KORCELLI**

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## LIST OF PARTICIPANTS IN THE FOURTH ANGLO-POLISH SEMINAR

### POLAND

1. Prof. K. Dziewoński, Institute of Geography PAN, Warsaw
2. Prof. T. Żebrowski, Institute of Geography PAN, Warsaw
3. Prof. Z. Chojnicki, Adam Mickiewicz University, Poznań
4. Dr. L. Barwińska, Maria Curie-Skłodowska University, Lublin
5. Dr. J. Grocholska, Institute of Geography PAN, Warsaw
6. Dr. A. Jelonek, Jagellonian University, Cracow
7. Dr. M. Jerczyński, Institute of Geography PAN, Warsaw
8. Dr. P. Korcelli, Institute of Geography PAN, Warsaw
9. Dr. habil. A. S. Kostrowicki, Institute of Geography PAN, Warsaw
10. Dr. E. Iwanicka-Lyra, Institute of Geography PAN, Warsaw
11. Dr. A. Synowiec, Institute of Geography PAN, Warsaw
12. Dr. habil. H. Szulc, Institute of Geography PAN, Warsaw
13. Dr. A. Zagożdżon, Wrocław University

### GREAT BRITAIN

1. Prof. R. H. Osborne, University of Nottingham
2. Prof. A. E. Smailes, Queen Mary College, University of London
3. Prof. K. C. Edwards, University of Nottingham
4. Prof. S. H. Beaver, University of Keele
5. Prof. D. Thomas, St. David's University College, Lampeter
6. Mr. F. A. Barnes, University of Nottingham
7. Dr. C. Board, London School of Economics
8. Mr. A. G. Champion, Oxford University
9. Mr. B. G. Clarke, University of East Anglia
10. Mr. J. A. Dawson, University of Nottingham
11. Mr. E. W. Entwistle, University of Nottingham
12. Dr. J. A. Giggs, University of Nottingham
13. Mr. G. D. S. Goddard, University of Salford
14. Miss R. Gurney, Queen Mary College, University of London
15. Mr. J. M. Hall, Queen Mary College, University of London
16. Mr. P. T. Kivell, University of Keele
17. Dr. A. J. Strachan, University of Leicester
18. Dr. P. T. Wheeler, University of Nottingham
19. Dr. H. P. White, University of Salford
20. Dr. E. M. Yates, King's College, University of London



## REPORT OF THE MEETING

The Fourth Anglo-Polish Geographical Seminar, dealing with the theme of "Urban-rural interaction", took place at the University of Nottingham from 6th to 12th September, 1970, under the auspices of the Institute of British Geographers. The Polish delegation of thirteen was led by Professor K. Dziewoński, Deputy Director of the Institute of Geography of the Polish Academy of Sciences, and the host-organizer on behalf of the I.B.G. was Professor R. H. Osborne. Amongst the twenty British participants were Professor A. E. Smailes, President of the I.B.G. for 1970, Professor K. C. Edwards, leader of the British delegation to the First Seminar, and Professor S. H. Beaver, host to the Second.

After departure by special coach from London Airport on the morning of Sunday, September 6th the Polish delegation were entertained to lunch at Jesus College, Oxford, by Mr. E. Paget before continuing their journey to Nottingham. Here they stayed for six days in Cripps Hall, where they were joined by the British geographers.

The programme consisted of working sessions involving the presentation and discussion of papers, and study-excursions illustrating the theme of the Seminar, organized by members of the Nottingham Department. On Monday, 7th, the Seminar began with a morning devoted to papers dealing with "Problems in planning the rural-urban fringe" (Thomas) and "The interaction of urban and rural land-uses on the periphery of Edinburgh" (Strachan), followed by "Village relict features within some Polish towns" (Szulc) and "Semi-urbanization" (Zagożdżon). The afternoon session consisted of papers on "Agriculture and New Towns in Great Britain" (Champion) and "The impact of Crawley New Town" (Clarke), while in the evening attention was given to aspects of the geography of retailing, represented by contributions on "The urban-rural retail structure in the East Midlands" (Dawson), "Retail change and decentralization in the Nottingham metropolitan community" (Giggs) and "Hinterlands of rural-urban interaction in the North-west Midlands" (Kivell).

On Tuesday, 8th, members of the Seminar travelled to Stratford upon Avon to attend an evening performance of Peter Brook's new production of "A Midsummer Night's Dream". A two-hour stop was made in Coventry in the late morning and lunch was taken in a hostelry adjoining Kenilworth Castle. The British Council made a generous contribution towards the cost of the theatre visit.

The work of the Seminar on Wednesday morning, 9th, was devoted to papers dealing with "Leisure motoring in Great Britain" (Hall) and "Long-distance commuting into London" (White and Goddard), followed by a talk

from Mr. P. C. Benneworth (Nottinghamshire County Planning Department) on "Rural planning problems in Nottinghamshire". After lunch Mr. Benneworth and Dr. P. T. Wheeler took members of the Seminar on a study-tour of south Nottinghamshire in order to see typical aspects of urban and industrial intrusion in rural areas. In the evening a cocktail party was held at Cripps Hall by invitation of Professor G. L. Seidler, Director of the Polish Cultural Institute in London. This was followed by a special Seminar dinner at which the guest of honour was His Excellency the Polish Ambassador, Dr. M. Dobrosielski. Other guests included representatives of the University of Nottingham and of the British Council. Professor K. M. Clayton (University of East Anglia), Treasurer of the Institute of British Geographers, was also present.

Further papers were presented on Thursday morning, 10th. There were contributions on "The socio-economic differentiation of Poland's spatial structure" (Chojnicki), "Emerging patterns of urbanization in Poland" (Dziewoński), "The role of functional specialization of cities" (Jerczyński) and "Changes in the character of migration movements in Poland" (Iwanicka-Lyra). In the afternoon there were papers on "The management of heathlands for amenity purposes in South-East England" (Yates) and a paper on "Urban allotment gardens in Britain" (Barnes). Professor H. Thorpe (University of Birmingham), Chairman of the recent government Committee of Inquiry into Allotments, was present for the occasion. In the late afternoon there was a visit to the Department of Geography, University of Nottingham. In the evening there was a paper on "Urban spatial growth: a wave-like approach" (Korcelli) as well as short papers on "Changes in the demographic composition depending on the urbanization degree" (Jelonek) and on "Regional migrations in Poland" (Barwińska).

On Friday, 11th, members of the Seminar made a tour of contrasting rural areas in Derbyshire, led by Professor R. H. Osborne, involving coal-mining villages, textile settlements of the Derwent valley, and the Peak District National Park. The day also included a visit to Haddon Hall, followed by a picnic lunch at Monsal Head. In the evening papers were presented on "Structural changes of biocoenoses under the influence of human activity" (Kostrowicki) and "Urban and rural participation in Poland's water economy" (Synowiec). The working sessions at Nottingham were closed by a vote of thanks to Professor Osborne and all those who had helped to make possible such a successful programme. In expressing the thanks of the Polish delegation Professor Dziewoński intimated that it was probable that a Fifth Seminar would be held in Poland in a few years' time. The members of the Seminar then accepted the following resolution:

The Fourth Anglo-Polish Geographical Seminar, meeting from 6th to 12th September, 1970, at the University of Nottingham, resolves as follows:

(1) That the continuing exchange of experience and opinions has been of great value;

(2) That for the better understanding of urbanization processes and of urban-rural interaction and for the improvement of relevant analytical methods, including those relating to planning problems, there should be further encouragement of geographical research;

(3) That a report on the Seminar should be published in British and Polish geographical journals and in the I.G.U. Newsletter, and that the Proceedings of the Seminar should be published;

(4) That the next Seminar shall be held in Poland, at a place to be decided later, in either 1973 or 1974;

(5) That the theme of the Fifth Seminar should be related to the problems of Man and his environment;

(6) That a vote of thanks be accorded to those members of the Universities of Nottingham and London who facilitated the provision of accommodation and the arrangement of excursions, and also to the British Council for financial support towards the cultural element of the programme.

On Saturday, 11th, the Polish delegation left Nottingham for London. On the way they were given a guided tour of the New Town of Corby by Professor K. C. Edwards before lunching in the attractive old-world village of Rockingham.

In London the delegation stayed for three nights at Nutford House (University of London), where arrangements had been made by Dr. E. M. Yates. He and other colleagues from the University of London organized geographical and sight-seeing visits on Sunday, 13th and Monday, 14th. On the Monday evening the Polish delegation were entertained to dinner at the National Liberal Club by Mr. E. G. Godfrey, an Honorary Member of the Institute of British Geographers, and the following morning, after an intensive but highly-rewarding Seminar lasting nine days, the Polish guests left for home from London Airport.



## THE SOCIO-ECONOMIC DIFFERENTIATION OF POLAND'S SPATIAL STRUCTURE

ZBYSZKO CHOJNICKI and TERESA CZYZ

### THE DIMENSIONS OF SOCIO-ECONOMIC SPACE

The subject of this analysis is the total socio-economic space of Poland. Geographical theory contains two approaches to an operational definition of socio-economic space. Firstly, the ontological approach conceives of socio-economic space as a mode of existence of economic processes; secondly, the mathematical and economic-geographical approach considers socio-economic space as a set, or subset, of geographical objects with specific inter-dependences. This study of Poland's socio-economic space consists of defining and explaining the regularities in the spatial occurrence of economic processes by analysing the properties of sets of objects and their vertical and horizontal interdependences. Thus conceived, the analysis of socio-economic space is closely linked to the study of the level of the country's economic development.

The present study is based on the assumption of a latent structure of socio-economic space. The total socio-economic space may be viewed as a set of partial socio-economic spaces comprising different features of socio-economic life, for example, demographic, industrial and agricultural and those relating to transportation and services. In spite of its plurality, this set is finite. The partial socio-economic spaces, though comprising different socio-economic phenomena, refer to the same reality in that they are reflections of some of its different aspects. Such partial spaces are interdependent, though clearly non-identical (Dziewoński [2], p. 37). The total socio-economic space is a resultant of all partial spaces that together constitute the latent structure of total space.

### METHOD OF IDENTIFYING STRUCTURE

As a method of identifying this latent structure, factor analysis has been employed. A fundamental postulate of factor analysis is that there is a set of latent factors underlying a given space. The latent factors help towards the explanation of the interdependences between observable features of phenomena. The relationships between the variables are related closely to the presence or absence of particular latent factors. Factor analysis provides, in this way, remarkable new possibilities for the identification of latent phenomena. By using this method economic-geographical studies need not be exclusively confined to analysing the features of visible economic processes, it may

be observed. Factor analysis is the model for measurements insofar as the identification of directly unobservable factors is concerned (Czyż [1]).

Factor analysis, in its function as a model for measurements of fundamental magnitudes in socio-economic studies, employs scaling. The student often wants to develop a scale in which individual phenomena are attributed a definite value and made comparable. The scale may refer to such phenomena as urbanization, industrialization or other conceptual variables. A fundamental problem in the derivation of a scale is the weighting of the component variables. Factor analysis furnishes solutions by dividing variables by their independent causes of variation. Each factor represents a scale based on empirical interdependences between variables. For the connected variables, factor analysis uses loadings derived from a mathematical model. The resulting factor scores are interval (not absolute) scales derived by linking these variables and taking into account definite loadings.

Thus, the factor analysis of the differentiation of the structure of socio-economic space in respect of measures of socio-economic reality:

- (1) reveals the essential patterns of socio-economic phenomena in Poland in the language of partial spaces and establishes their hierarchy,
- (2) defines the homogeneity of these spaces and determines if they have a regular regional structure,
- (3) examines the horizontal and vertical spatial relationships.

Our point of departure is a set of 33 variables reflecting the economic life of Poland:

- ( 1) Population density
- ( 2) Population increase per 1000 inhabitants
- ( 3) Percentage of urban in total population
- ( 4) Percentage of economically active in total population
- ( 5) Percentage of economically active outside agriculture in total number of economically active population
- ( 6) Percentage of non-agricultural employment in total population
- ( 7) Agricultural population per 100 ha of agricultural land
- ( 8) Per capita investment expenditure at current prices (Zlotys)
- ( 9) Investment expenditure at current prices per 1 sq. km (.000 Zlotys)
- (10) Value of fixed assets per 1 sq. km (.000 Zlotys)
- (11) Industrial employment per 1000 population
- (12) Industrial employment per 100 sq. km
- (13) Per capita gross industrial output (Zlotys)
- (14) Percentage of agricultural land in total area
- (15) Share of cereal cultivation in total sown area (‰)
- (16) Share of potato cultivation in total sown area (‰)
- (17) Share of sugar-beet in total sown area (‰)
- (18) Cattle per 100 ha of agricultural land (head)
- (19) Pigs per 100 ha of agricultural land (head)
- (20) Per capita wheat crops
- (21) Percentage of electrified private farms in total private farms
- (22) Forest area *per capita* (ha)
- (23) Share of forest in total area
- (24) Length of railway lines per 100 sq. km
- (25) Length of roads covered by bus routes per 100 sq. km
- (26) Number of train-kilometres within 24 hrs per 100 sq. km
- (27) Number of bus-kilometres within 24 hrs per 100 sq. km

- (28) Number of train-kilometres within 24 hrs per 10,000 population
- (29) Number of bus-kilometres within 24 hrs per 10,000 population
- (30) Population per socialized retail-trade establishment
- (31) Sales by socialized retail-trade per capita (Zlotys)
- (32) TV subscribers per 1000 population
- (33) Physicians per 10,000 population

The variables comprise population, industrial and agricultural outputs, transport, and services in 1965.<sup>1</sup> Socio-economic phenomena have a definite location within a modified administrative division consisting of a total of 324 areal units at the level of *poviats* (Fig. 1). The modifications to this division consisted in, firstly, including 61 towns with the status of *poviat* in adjoining rural *poviats*, and secondly treating the 5 city-voivodships, the 10 towns of the Upper Silesian Industrial District, and the Trójmiasto (i.e., the three coastal towns of Gdańsk, Gdynia and Sopot) as separate areal units. The inclusion of town *poviats* in the rural *poviats* seemed reasonable, for a town is integrally connected with the territory of the rural *poviat*. The adopted frame of reference of the phenomena corresponds directly with the administrative division, which is itself closely connected with the pattern of the spatial organization of economic activity.

It ought to be emphasized that, from the standpoint of the aims of the present study, the statistical data at hand unfortunately fail to represent all the essential properties of socio-economic space and, besides being based on relatively large spatial units (the *poviats*), they furnish an all too generalized picture. This results from the difficulties in collecting more complete or detailed statistical material.

## RESULTS OF THE STUDY

The factor analysis of a matrix of variable correlations made by the principal factor method with Hotelling's iteration algorithm produces 3 significant common factors, accounting for 66.13% of the total variance.<sup>2</sup> The factor structure is hierarchic in its nature (Table 1).

TABLE 1. Factor structure

Factor	Eigenvalue	Common variance explained by factor	
		% explained	cumulative % explained
$F_1$	11.475	38.33	38.33
$F_2$	4.751	15.90	54.23
$F_3$	3.564	11.90	66.13

<sup>1</sup> For lack of space the set of initial statistical data and their sources are not given. Figures 1-6 at the end of the book.

<sup>2</sup> The programme for factor analysis written in the Gier-Algol language employed the principal factor method on a Gier computer.

The identified factors represent the fundamental dimensions of the 33-variable socio-economic space. These theoretical metafeatures are linked with definite clusters of observable variables. The nature of the factor must be inferred from the contents of these features (Table 2). Since the factors are bipolar, they express a property that may have either a positive or a negative score.

TABLE 2. Factor matrix

Variable	$F_1$	$F_2$	$F_3$
1	0.7885	0.4675	-0.1579
2	-0.1530	-0.6501	-0.0471
3	0.8825	-0.2012	-0.0903
4	-0.4681	0.6551	-0.0298
5	0.8921	-0.2851	-0.0708
6	0.8570	-0.3281	-0.0542
7	-0.0678	0.7837	0.1561
8	0.2631	-0.0485	-0.0388
9	0.7816	0.4346	-0.1712
10	0.7896	0.3987	-0.1647
11	0.7734	-0.0468	0.0740
12	0.7668	0.4220	-0.1682
13	0.7461	-0.0162	0.1239
14	-0.3682	0.3192	0.6970
15	-0.6064	0.1167	-0.2220
16	-0.0061	0.3974	-0.5177
17	0.0591	-0.1270	0.7255
18	0.0995	0.0535	0.4253
19	0.2076	0.3504	0.1486
20	-0.1435	-0.2506	0.7208
21	0.5356	-0.4860	0.1756
22	-0.2450	-0.5018	-0.6424
23	-0.0512	-0.4888	-0.6563
24	0.7858	-0.1584	0.2190
25	0.4858	-0.2506	0.5745
26	0.7803	0.2945	-0.0935
27	0.7467	0.3883	0.0901
28	0.1527	-0.5610	0.0758
29	-0.2966	-0.2825	0.1173
30	-0.2099	0.5386	0.0303
31	0.8620	-0.1589	-0.0091
32	0.8945	-0.2464	0.1217
33	0.7743	0.1075	-0.1797
Per cent of common variance explained by factor	38.33	15.90	11.90

Factor  $F_1$ , which explains 38.33 per cent of the total variance, is the major factor. Its structure, in terms of features correlated positively with this factor, is composed of the following elements: (1) urban and non-agricultural population, (2) industrial activity, (3) transport, (4) services. Thus, this factor compri-

ses an assembly of fundamental features which are indicators of urbanization and industrialization. The criterion of urban population and, as a corrective, that of the percentage of nonagricultural employment, are in Polish conditions the fundamental indicators of the urbanization level.

According to Leszczycki and Wróbel [4], the processes of rapid urbanization in Poland find their expression not only in the growth of urban settlement patterns but also in the penetration of urban modes of life into rural areas. Statistically, this is reflected in changes in the occupational structure of the rural population seen in terms of the growing share of non-agricultural occupations. The most important cause of the quantitative domination of non-agricultural population in the rural areas is the daily commuting to work in industrial establishments in towns. Moreover, those among the rural population who are employed in industry do not always give up their work on the farm. Hence the growing number of what are called "worker-peasants". Another cause is the process of industrialization of the rural poviats.

Factor  $F_1$  contains also "pure" indices of industrialization: industrial employment, total industrial output, the value of fixed assets, investments, and the level of transportation development. It must be pointed out that the aggregation of the observable features of urbanization and industrialization into the category of factor  $F_1$  is fully justified due to the existence of different feedbacks between these two processes. Factor  $F_1$  is identified as the factor of the level of urbanization and industrialization.

Urbanization and industrialization are elements of a more general process of modernization. The identification of the syndrome of modernization may thus be of some use for the determination of the level of the country's economic development.

TABLE 3. Distribution of factor variation\*

Factor	Maximum value	Minimum value	Difference
$F_1$	65.86	-15.71	81.57
$F_2$	19.33	-10.67	30.00
$F_3$	10.41	-11.55	21.96

\* Factor scores are expressed by normalized non-denominated numbers, i.e., with an arithmetic mean equal to 0

Factor  $F_2$  explains 15.90 per cent of the total variance and reveals the second pattern of linkage of variables. This factor exhibits positive correlation with the features of agricultural population per 100 ha of agricultural land, economically active population, and population per establishment of socialized retail trade. It is striking that the agricultural population density is in strict positive correlation with the economically active population. This is due to the imprecision of the population's activity coefficient, caused by the application of a specific principle in distinguishing the active population. Polish statistics include among the working population all women living in rural areas and thus the number of economically active people in agricultural areas is overestimated. Thus it can be said that the feature "agricultural population density" is a leading variable of this pattern. Factor  $F_2$  is thus the human factor in agriculture.

Factor  $F_3$  is similar to factor  $F_2$ , as far as the percentage of the common variation explained (11.90) is concerned. Interpretation of factor  $F_3$  is based

on its positive correlation with some measures of agricultural intensity of productivity, such as the percentage of agricultural land, the share of intensive crops in the total cultivated area, the density of livestock, and yields of wheat per capita. Factor  $F_3$  is identified as the factor of the level of intensity in the agricultural economy.

As expressed in terms of factors, the fundamental information on the basic socio-economic situation in Poland is contained in a matrix of factor scores of the order  $324 \times 3$ .

The frequency distributions of the values of the three factors are notably different. The form of these distributions is closely related to the amount of spatial variation of the phenomena indicated by these factors (Table 3).

The examination of the spatial pattern in the dimensions of the respective factors is indicated by a one-factor classification of the spatial units. There are 9 homogeneous classes of areal units. Their respective scores are given in Table 4.

TABLE 4. Class intervals of factor scores

Class (type)	Class intervals
I	-20 to -10
II	-10 to -3
III	-3 to -1
IV	-1 to 0
V	0 to +1
VI	+1 to +3
VII	+3 to +10
VIII	+10 to +20
IX	+20 to +70

The presentation of the morphology of the respective factor spaces is begun with the human factor in agriculture ( $F_2$ ), which, although being on a lower level in the factor hierarchy, has a conspicuous regional character (Fig. 2).

A preliminary comparison of the distribution map of factor  $F_2$  with that of the socialized forms of agriculture shows that the distribution of agricultural population is, to a wide extent, the reverse of the distribution of socialized farms. Thus, in virtue of two value classes of factor  $F_2$  (positive and negative), two types of area may be distinguished. The first type are areas of normal, or relatively insufficient, saturation with agricultural population and predominantly of socialized farms. The second, opposite type indicates areas of a high density of agricultural population and private farms.

The analysis of the distribution of these types leads to a division of Poland into two large, distinctly delineated regional units, which are fundamentally opposed to each other in the specific social structures of their agriculture. The Region of Western and Northern Poland is marked by a density of agricultural population below the national average, a well-developed socialization of agriculture, and a predominance of middle-sized and large farms in the private sector. This Region includes the voivodships of Szczecin, Koszalin, Gdańsk, Olsztyn, the north-western part of the Białystok voivodship (*poviats* of Gołdap, Olecko, Ełk, Augustów), Zielona Góra, Poznań without its eastern *poviats*

(Słupca, Konin, Kcło, Turek, Pleszew, Kalisz, Ostrzeszów), Bydgoszcz without the south-eastern part (Radziejów, Włocławek, Aleksandrów Kujawski, Lipno, Golub-Dobrzyń, Rypin *poviats*), Wrocław, Opole, and the *poviats* of Lubliniec, Tarnowskie Góry, Gliwice and Zabrze in the voivodship of Katowice. This Region is homogeneous in terms of the space under discussion and it contains only two small enclaves of the second type, the city-voivodship of Poznań and the Trójmiasto.

The Region of Central and Eastern Poland (embracing the voivodships of Łódź, Warsaw, Białystok, Kielce, Lublin, Katowice, Cracow and Rzeszów), with surplus agricultural population and a conspicuous predominance of small private farms, exhibits less homogeneity. The south-eastern part of the Region, where socialized farms were established on land formerly belonging to Ukrainians; the south-western part, which is strongly industrialized; and a few enclaves, with agriculture of the suburban type, together represent the opposite type.

The economic space of social forms of ownership can be regarded as a frame of reference for the economic activities in agriculture, i.e., the space of factor  $F_3$ .

The examination of the geographical distribution of factor  $F_3$  reveals a high heterogeneity of the space of the level of intensity of agriculture. The spatial pattern of the types of agriculture, which are based on 8 classes of value of factor  $F_3$ , constitutes a mosaic structure (Fig. 3).

The particular types of agricultural intensity interlace with each other in space, yielding a fairly complex picture. Only after a generalization of the patterns of agricultural types effected by joining related, "positive" or "negative", types into contiguous territorial units can the delineation of two zones of highly intensive agriculture be achieved. The first of these zones constitutes the axis of the space discussed here; it runs from the south-west to the north. This zone has a distorted shape suggestive of several sections, namely the Silesian district, the Great Poland district (the south and east of Great Poland), the East-Pomeranian district, with its extensions into Kujawy, and the Łódź-Warsaw area. The second zone, in southern Poland, which extends roughly parallel from west to east, is much weaker in its delimitation and is composed of the areas of Miechów-Sandomierz and Lublin. The interzonal area, as well as those on the outer margin of the distinguished zones, exhibit, generally, a low intensity of agriculture, but they include three enclaves of highly intensive agriculture, the areas of Pырzyce, Przeworsk and Kętrzyn.

By synthesizing the space of the level of intensive agriculture with its background of the social forms of ownership in agriculture, we obtain a resultant configuration of the integrated space representing the vertical and horizontal relations of the components. In terms of numerical taxonomy, this type of approach denotes a two-factor classification of the set, using, for simplicity, four types by quadrants (Fig. 4).

The geographical picture of this type of pattern is marked by the occurrence of types without spatial contiguity (Fig. 5). The original morphology of the space-basis of a strongly regional character has been distorted. The relatively high coefficient of agreement (0.53) of the system  $F_2F_3$  requires some careful comments on its spatial aspect. The inner area of the Region of Western and Northern Poland has been subjected to a differentiation in terms of the types: firstly non-accordant, with agricultural population density below the national level and a high intensity of agriculture; and secondly, accordant, showing the opposite position.

The first type covers the southern and western parts of the voivodship of Opole, nearly all of that of Wrocław, the southern and north-eastern parts of those of Poznań and Bydgoszcz, the eastern part of Gdańsk voivodship, the western and northern part of that of Olsztyn, and the areas of Gryfice, Pyrzyce, Szprotawa, Szamotuły. Thus, it is represented by areas of high agricultural intensity. This is a consequence partly of the proximity of large population groupings and industrial agglomerations, and partly of the occurrence of good soils without any notable surpluses of agricultural manpower.

The second type covers the voivodships of Szczecin, Koszalin, the western part of Gdańsk, the northern part of Bydgoszcz and southern part of Olsztyn voivodships, the voivodship of Zielona Góra, the western part of Poznań voivodship and the borderland between it and Koszalin voivodship, the eastern part of Opole voivodship and enclaves in Wrocław voivodship. These, especially in the north of Poland, are marked by a low population density, a relatively low percentage of agricultural land and by the extensive character of their agricultural economy.

In the Regional of Central and Eastern Poland, the accordant type, positively correlated with intensive agriculture and surpluses of manpower, occurs in several distinct areas, notably,

(1) Kujawy, the western part of Warsaw voivodship and the northern part of Łódź voivodship,

(2) The northern part of Cracow voivodship, the southern part of Kielce voivodship, the voivodship of Lublin, the areas of Przeworsk. These areas have very good soils with a low intensity of agriculture and a high level of fragmentation of farms and hence have considerable latent surpluses of agricultural manpower.

Generally, it can be said the differentiation of agricultural space has, on the one hand, its historically-conditioned demographic reasons and, on the other, its physiographical justification particularly in respect of soil fertility.

In addition, the pattern of the level of urbanization and industrialization is superimposed upon the spatial differentiation of the agricultural economy. The specific character of the industrial-urban pattern consists in the extreme non-contiguity of the space of urbanization and industrialization (Fig. 6).

Areas of the industrial-urban type of development occur scattered throughout agricultural areas, especially in the eastern part of the country, comprising the areas of Łódź, Warsaw, Płock-Włocławek (including Kutno), Giżycko-Elk, Tarnobrzeg and the individual cities of Cracow, Tarnów, Rzeszów, Kielce, Radom, Lublin, Białystok and Olsztyn.

The western part of Poland has a well-developed industrial zone, which, however, is not homogeneous. Within this zone the following sub-spaces may be distinguished:

(1) The Upper Silesian area, consisting of 10 poviats with a very high level of urbanization and industrialization. These *poviats* are relatively contiguous, linked through the southern part of the Opole voivodship to the Lower Silesian area, which in turn extends to the north into the areas of Zielona Góra and Górzów, while in the east it passes into the area of Great Poland.

(2) The coastal area, which is non-contiguous.

(3) The area of the lower Vistula.

The forms occurring in these urban and industrial zones are externally differentiated. Their cores, where the phenomenon reaches its maximum, are situated in the Upper Silesian Industrial District, Bielsko-Biała, Wrocław city, Poznań city, Szczecin and the Trójmiasto.

## CONCLUSION

This analysis of the spatial structure of Poland indicates three factors determining the spatial patterns representative of the overall socio-economic situation of the country.

The spatial patterns created by the first factor, which is interpreted as the pattern of urbanization and industrialization, exhibit the formation of regional groupings of the semi-urban type, that is represented by metropolitan and urban areas as well as by industrialized areas within areas of actively developing agriculture. This factor furnishes essential data for the appraisal of the level of socio-economic development. At the same time, it discloses the specific properties of the urban economy and allows the determination of the position of an area within an urban-rural continuum. This factor pattern can therefore be treated as a classifying category in the study of urban-rural duality. The high position of some poviats in the scale of industrialization and urbanization is a manifestation of the complexity of particular urban economies.

The other two patterns of the socio-economic space, viz. the human factor in agriculture and the factor of level of intensity of agriculture, do not represent definite stages of development in the socio-economic continuum. Thus they do not enable us to establish the position of an area in the lower part of the evolutionary chain of economic structures. Consequently, they are useless for the identification of the type of rural economy, for they do not refer to the differentiation of rurality. On the other hand, factors  $F_2$  and  $F_3$  constitute component elements of the space of agricultural phenomena. They affect the stratification of the spatial structure of agriculture in its horizontal aspect.

Adam Mickiewicz University, Poznań

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## EMERGING PATTERNS OF URBANIZATION IN POLAND

KAZIMIERZ DZIEWOŃSKI

To discuss patterns of urbanization we have first to define the term. In doing this I shall largely depend on the results of the discussion held in April 1970 at the first London meeting of the International Geographical Union Commission on Processes and Patterns of Urbanization, while I take full responsibility for the formulation here presented.

Urbanization is a complex social process involving the transformation of the whole nation, or its parts, from a rural to an urban society. It is a change in the mode of life and in that respect differs from industrialization, which is a process of change in the means and forms of production. Although there are undoubtedly very important interrelations between these processes, urbanization is mainly a social process while industrialization is basically economic.

Obviously such a definition is broad and immediately there arises the question of measuring the extent and the progress of urbanization. Various measures have been used or proposed. When applied to the study of Polish urbanization each gives a somewhat different picture of its past or present state. Let us review briefly a series of specific indices, each showing a different aspect of urbanization in Poland. Among them are:

- (1) relation between the total population and the urban population, i.e. the population living in the areas that have urban administrative status;
- (2) relation between agricultural and non-agricultural population;
- (3) index of industrial population and/or employment;
- (4) distribution of the so-called peasant-workers;
- (5) industrialization of agriculture, as expressed for instance by the numbers of agricultural wage-earning workers and of tractors per hectare of arable land;
- (6) accessibility of rural population to urban services;
- (7) movement of population from rural areas to settle in towns;
- (8) commuting to work;
- (9) recreational migration of urban population.

Let us look first at the traditional, commonly-used index of urbanization — percentage of urban population according to the Census definition. It shows an uneven distribution, with the main concentrations of urban population in the southern part of the country in the Upper Silesia-Cracow industrial region. In particular the Upper Silesian conurbation stands out, but so also do several other large cities in the central and northern parts of the country. This picture

may be extended in depth by additional information pertaining to the distribution and density of urban settlements. It underlines regional differences created by the distribution of natural resources as well as historical variations in the growth of urban networks.

The second index, i.e., percentage or density of non-agricultural population, brings out the well-known fact that urbanization processes are not limited only to urban administrative units. Such indices represent simultaneously the spread of urbanization as a result of another process, that of industrialization and its corollary, higher productivity in agriculture. It also reflects the phenomenon of spatial explosion of big cities. The first element, the effects of industrialization, is better shown and measured by the percentage of industrial population or employment; the second comes out clearly only by the detailed analysis of the percentage of non-agricultural population in predominantly agricultural regions. Then the difference between the western and eastern regions, marking not only the higher productivity of the former but also the more urbanized countryside, is remarkable indeed. But urbanization in rural areas is not connected solely with the size of the non-agricultural population. It goes even further, transforming at present not only the structure of rural population but even the agricultural component itself. The distribution of the so-called "peasant-workers" shows the spatial extent of the impact of industrialization on peasant families and households. Usually one member of the family, probably its head, works in industry, commuting (although not necessarily) to work in the city. The additional qualification, and acquaintance with urban society, gained by work in industrial establishments, as well as the money income from urban employment slowly but surely change the mode of life of the whole rural population wherever this phenomenon of the peasant factory-worker develops. With the industrialization of farming techniques (mechanization and the use of chemical fertilizers and pesticides) urban ways infiltrate into the agricultural sector also. These are obvious factors, yet the most important is the introduction of fixed hours of work, which comes with the employment of wage-earning workers in both state and cooperative farms as they progressively supersede the small peasant land-holders.

The urbanization of life in the rural areas is strongly associated with accessibility to urban services. This can be measured by the development of transport (e.g. the number and frequency of bus routes and services); another comparatively recent factor is the progress achieved in the transmission of information of various kinds that are mostly connected with, and characteristic of, urban culture. A fairly good index here is provided by the number of television sets per 1000 inhabitants. The significant fact here is that the differences between rural and urban areas are diminishing.

The spatial explosion of the big cities into extensive metropolitan areas involves the conceptual and methodological problem of their delimitation, which I shall not discuss here. However, some kind of map of metropolitan areas should not be omitted in the analysis, since it shows an additional aspect of the present spread of urbanization.

The remaining three indices are derived from the dynamics and movements of population. The first depicts permanent migration, the other two periodic rhythms, to work and for recreation.

If we assume — as is constantly done — that permanent migration corresponds to and parallels in some way the processes of urbanization, then

the areas of influx of population represent the regions of active change where urbanization is increasing, and the areas of efflux those where it is passive.

The analysis of commuting to work is significant for delimiting larger industrial and urban regions that are characterized by a more intensive development of urbanization. The recreational regions, on the other hand, show the opposite. They indicate how urban culture infiltrates into the agricultural population, or at least into the rural areas, which are usually less accessible to other forms of urban influence.

Can all these varying representations of urbanization be summed up in a synthetic index for what is basically a single problem, and then be split into a few spatially-significant coefficients? Or alternatively, is it possible to limit our analysis to the basic spatial patterns of urbanization? One way of proceeding would be to use multifactor analysis. This has already been done several times, although with results that are either banal or otherwise rather unsatisfactory. The number of factors involved is after all rather small and the method unnecessarily sophisticated and too complicated for the required analysis.

It seems, therefore, preferable to develop a quite different approach. Let us assume that the whole urban network, or even better the whole settlement pattern, represents an economic and social system. Then we shall interpret progress in urbanization as a development within this system that takes place throughout the national territory (or space). Thus we shall perhaps be able to identify the varying patterns of urbanization with specific subsystems. Whether such subsystems represent successive stages in the development of urbanization will have to be elucidated later on the basis of the results of the analysis undertaken.

The assumption of the existence of a system — the urban or settlement system — when applied to the concrete geographical area involves some additional concepts and problems. The more important are:

- (1) the definition of the system in contraposition to the external world — its closure and openness;
- (2) the definition of its internal structure — its subsystems;
- (3) the delimitation of the system and its subsystems;
- (4) the analysis of the cohesion of the system as well as of its subsystems;
- (5) the study of the stability or permanence of the whole system;
- (6) the additional study of the transformations taking place within the system, and in particular of the growth of the whole system.

It is easy to identify most of these items with the definition of a system as presented by David Harvey in his book *Explanation in Geography*. In fact, the two first items may be identified with general conditions involved in any definition if it is to be logically correct (*genus et differentia specifica*). But the emphasis I place on measuring the cohesion and the permanence in analysing the urban and settlement systems seems to me to be rather novel. These two elements are — in my opinion — essential for establishing connection between the initial concept (representing either a hypothetical or fully theoretical model) and reality. Moreover, the urban system is both a temporal and spatial phenomenon, and we should describe its growth by the changes in its specific attributes and internal relations.

On the basis of the preceding remarks let us now look at the full set of Polish cities and other settlements and consider whether to speak here in terms of an urban system is realistic and whether the analysis of such a system

will add to our better understanding of the structure and processes of urbanization.

The fact that all settlements within the boundaries of the Polish State form a closed system is fairly obvious, since they may easily be identified with the whole national economy and in modern times State units provide the most clearly established and crystallized economic regions. Moreover, in Poland foreign trade, although it is steadily increasing and becoming more important for the total growth of the national economy, does not yet form a very large proportion of the total economic activities.

To define the internal structure of our settlement system is more difficult. It is easy to assume that we should set apart as a subsystem the metropolitan areas. The main difficulty in this case is to decide whether the metropolitan areas are a subsystem or represent a loose collection of subsystems in which each metropolitan area is really a separate and independent subsystem. And we have still to define what constitutes a metropolitan area.

Let us first tackle the second problem as it is much easier. There is a general agreement that a metropolitan area represents an urban settlement complex with at least one large city in its centre. How large a city? Some say its population should be over two hundred thousand; for others a hundred thousand is sufficient. On the first assumption, there are only nine metropolitan areas in Poland, on the second, fifteen, with three more based on smaller urban centres following closely behind. Perhaps this additional group of nine areas represents the near future, and the first one the present. Of this total five (two larger and three smaller) represent a continuous territory which may be called the Upper Silesian and Cracow Industrial Region and may easily be considered as a specific subsystem of metropolitan areas within the national urban system. In this case, and assuming that we are not in a position to decide whether all Polish metropolitan areas form a subsystem, we may say that among our subsystems at least one metropolitan region and about seven metropolitan areas should be included. On the other hand, since these represent over one quarter of the total population (perhaps even one third) and more than half of the total urban population, account for almost half of all industrial production, and also contain an overwhelming majority of all national (and also regional) services (such as institutions of research, higher education, culture, offices of central and regional government), the assumption that they form a separate subsystem seems to be realistic. In some respects it is markedly different from the remaining areas and settlements and it is strongly inter-connected and coherent.

The remaining cities discharge the dual functions of central places on regional (*voivodship*) or local (*poviat*) level and specialized, mainly industrial centres. M. Jerczyński's study shows that the proportions vary. There are cities in which central functions are more or less dominant, but in a number of cities the specialized functions are far more important. The cities in which regional central functions dominate, together with those of lower rank in their region, may easily be distinguished as the regional subsystems. It is more difficult to decide in what subsystems the strongly specialized cities should be included. They may be located within a metropolitan area (in which case they belong to an already defined subsystem) or within the territory of one of the regional subsystems. In the latter case, however, they overshadow their region by reason of their national importance. These cities very often form a sort of subsystem within the national system, but in most cases such a subsystem functions only within one branch of the national economy (e.g. the

centres of steel or heavy chemical industries). Such subsystems overlap and practically never form spatially distinct and integrated regions. The best solution, therefore, seems to be to consider them as satellites of metropolitan areas or even as the growth poles for emergent metropolitan areas.

Among the specialized cities and settlements one class deserves special mention because it is growing very quickly both in numbers and in size — namely: recreational places, found mainly in the mountains, on the sea coast and in the lake-lands.

Incidentally there are also some remnants of regional subsystems of central places around at least some of the metropolitan areas. Indeed we should perhaps consider the Polish urban system as composed of two contrasting subsystems: metropolitan areas and regional complexes of central places with border cases of specialized centres within the complexes of central places and the remnants of such complexes surrounding, although not included in, one of the metropolitan areas.

I shall not discuss in detail the problems of delimiting subsystems. The methods, whether by single indices that are considered significant or by a weighted aggregate index or by multifactor analysis, are already fairly well defined and may be chosen and adjusted according to the available data, the specific character of the area and practical (usually the planning) considerations. What is really needed is a comparative analysis of the results to enable us to understand better the advantages and disadvantages of each method or index, and their sensitivity to different factors acting in varying conditions. Such an analysis would probably throw a new, additional light on the complex problem of limits of specific subsystems as well as on dividing lines and transition zones between them.

In my opinion the cohesion and permanence of the urban system are the major problems to be studied and measured. As the concept is new the methods have not yet been worked out and our knowledge is still very limited. These are clearly important research problems for the near future. The crux of our interests is here concentrated upon the existence, strength and durability of interrelations between various elements of the system (or the subsystems) as compared with the same or other interrelations with the outer world or with their own internal activities. Obviously, various methods for testing such phenomena may be used. One of the more interesting, recently developed in Poland by I. Czarnecka (Wrocław School of Economics) and A. Zagżdżon (Wrocław University), has been based on the application of graph theory and analysis. The main difficulty, however, lies in the lack of properly ordered sets of observations and data. This lack of sufficient knowledge at present seriously hampers the wider use of the whole concept of urban systems. However, we may use some indirect evidence in defining the strength of such systems. For instance in Poland the value of global production of nationalized industrial plants under regional and local administration amounts to only 13% or 14% of the total production and even in the least industrialized regions it is rarely greater than 30%. Taking into account the fact that the industrial plants (with some exceptions in the extractive and food industries) are located within the urban areas, this shows the strength of the national urban system as compared with the regional ones. Similarly the data for rail and road transport of goods show that internal, regional flows do not account for more than one third of the total transport measured by tonnage and even less by value. The same applies to similar data for the least industrialized and

urbanized regions. This shows that their internal flows, although higher, do not amount to more than one half of the total in weight and to less in value. Taking into account the fact that cities and towns are the main foci generating transport, it is clear that national urban system is much stronger than the regional ones and the state of integration into this system must be an index of economic development for a region.

On the other hand, the strength of the metropolitan areas as a subsystem in relation to the outside world may be estimated on the basis of population potential or intensity of commuting. The number of commuters in comparison with the total employment may serve as a pointer to the internal cohesion, although here a shift from the analysis of the data aggregated by administrative units to data ordered by one or other measures of distance is necessary, but difficult to effect.

We have at present an interesting series of studies on local settlement complexes in Poland, some of which were presented at our earlier seminars. A paper by Zagózdzon gives in this volume an interesting insight into the connection between the structure and growth of such complexes and their economic development, specifically the phenomenon of industrialization.

This statement brings us to our final problem in considering the urban system as a distinct geographical area, namely the problem of its transformations, and in particular the growth of a system. In some respects Poland presents an ideal case for such a study. Her urban system was first fully developed in the Middle Ages. In spite of all vicissitudes it survived almost unchanged until the nineteenth century. After the fall of the Polish State and the political division of its territory between three great powers in the eighteenth century, it still preserved its cultural and to some extent also its economic unity. Its breakdown became apparent only with the growth of modern capitalistic economy, and this took place in each of the three former empires in a different fashion. Consequently, at the beginning of the present century, there was not one but three largely independent urban systems. The modern story of urbanization in contemporary Poland can be presented, therefore, as one of the re-establishment and integration of a unified national urban system. Obviously there were two stages: the inter-war period and the period since 1945.

The first fairly obvious consequence of the re-established Polish urban system was the re-ordering of the hierarchy of the regional and local administrative centres, a powerful factor in the growth of individual cities. This was necessary because the administrative units of each of the occupying powers varied both in functions and size. Moreover, the scarcity of trained and fully-qualified civil servants of Polish descent (for Poles the road to an official career was open practically only in Austria) led to the choice of an administrative model with rather large regional units. This led to the quickened growth of a few of the larger of the middle-sized cities. But more important was the re-allocation of the central national functions among the largest cities. In the earlier period of great urban migration Warsaw had been only a secondary provincial centre without any greater political importance. The cultural life of the nation had concentrated in the south-eastern, Austrian part of the country, mainly in the ancient capital of Cracow, if not in various cities outside Poland, such as Paris, Swiss Freiburg, Brussels, Vienna, St. Petersburg, Riga and Kiev. Today Warsaw is clearly the capital — political, social, cultural and scientific — although it is not the largest urban agglomeration or the strongest economic centre. Some elements of the past still persist

and the Polish urban system is polycentric, less concentrated at the highest (national) and the lowest (local) levels but more concentrated at the intermediate (regional) level than in most other countries. Italy and Yugoslavia show some resemblance to Poland in this respect.

On the other hand, the processes of specialization in urban functions, which began in feudal times, went on unimpeded and perhaps were even hastened by inclusion in the great political entities with their large-scale economies and big markets. Such specialization had all the characteristic marks of capitalistic exploitation in underdeveloped countries. Political unification, followed almost immediately by the great world economic crisis, created the need for far-reaching adjustments in those specializations. In consequence industrial production at no time during the inter-war years reached the peak level of 1913 and 1914. The situation was aggravated by reduced possibilities for emigration abroad, which had been important up to the First World War in dealing with the consequence of the population explosion that had taken place in Poland in the last quarter of the nineteenth century. This role was taken over completely by urbanization. The situation was only partly relieved by the efforts in late thirties to speed up industrialization by the creation of a new industrial region in Central Poland. The real turn in both industrialization and urbanization came after 1945 (more precisely after 1949) within the framework of the planned socialist economy.

In dealing with definition of the subsystems within the urban system we have ascribed a special role to the concept of settlement complexes. How are the transformations of a system reflected in such complexes, in their structures? Nobody in Poland questions seriously that traces of the past still survive in the form of some specific urban-rural settlement complexes at a local and even regional scale. Specialized settlement complexes possess a very long and sometimes very rich tradition. In Poland such complexes were very early connected with mining and metal-working (in particular in the foothills and in the mountains—in conformity with Geddes' concept of the Valley Section), with the production of arms and the military organization of the country, with the production of cloth, leather and furs, as well as with the production of honey and venison in the forest regions. Among these there survived until the nineteenth century those connected with metalworking and textiles (although concentration of production strongly affected the location of plants). Some new ones, connected with coal mining and oil extraction, were added. The dividing political frontiers hampered their growth, although they helped the development of new textile-settlement complexes at the expense of the traditional ones by reason of the imposition of heavy customs duties and the opening of access to some very large markets. The re-unification of the national territory was accompanied by the growth of metropolitan areas around the largest cities. Previously this was seriously limited by the severe building restrictions imposed by military authorities, who treated these cities as fortresses defending the border regions of the great empires. Since that time the metropolitan areas have been increasing in population and extent, as well as in importance in all aspects of the national life. They show stages of structural and spatial development similar to those of the metropolises of Western Europe and North America. But their internal decentralization was recently obscured, at least temporarily, by the reconstruction of the war-devastated central districts or by the planned construction of hitherto undeveloped central service facilities in the neglected, but large and important industrial cities.

These stages of development are more or less as follows: first, various rings of specific urban land uses develop (well within Thünen's basic concept), then, with improvement in the lines of communication and transport growth along these quickens and radial, linear forms develop. The third stage sees the emergence of satellite cities, either by accretion of new functions to the existing centres or by the establishment of new centres. The typical, wave-like phenomena (corresponding to Korcelli's concepts) become evident and the hitherto local patterns become complex, multi-level and regional.

Such was, in general, the sequence of development in the metropolitan areas that grew from and around one large city. It is different in the case of industrial conurbations. There the first stage sees the emergence of various industrial towns and villages, which slowly coalesce into the mosaic of an industrial area; the second stage comes with the crystallization of the main urban centre or centres. The characteristic sign of maturity for such an industrial community comes with the development of its ability to transform or to modernize its functional basis, i.e., its profile of production and specialization.

An additional interest in both forms of growth of metropolitan areas lies in the fact that they tend in time to become very similar. Some kind of entropy seems to take place within the urban system in spite of the fact that the path followed by the subsystems to their maturity has been so very different. In the first case the central place became an industrial and specialized region; in the second an industrial region turned into a kind of central place.

The modern metropolitan area makes possible a greater social and physical mobility for its inhabitants, providing in general more opportunities of employment and better living conditions. It may be considered, therefore, to be a major bearer of urban civilization, of urban ways of life, in other words, of urbanization. The question then arises whether in future, alongside further economic and social development, the whole of Poland will become one great metropolitan area, dissolving in this way the traditional contraposition of rural and urban communities, equating and integrating them together; or whether the future lies in the functional division of roles between various regions and zones in the country representing together, as A.E. Smailes puts it, a rural-urban continuum? Without answering this question finally it is possible to say that in the near future, in the next twenty-five or thirty years, Poland will still present a mixed system of traditional rural-urban regions alongside numerous metropolitan areas growing more like each other with the passage of time.

To end this paper it seems fitting to describe briefly the programme of research into the phenomena of urbanization that is to be carried out in the near future within the framework of the Polish National Plan for Scientific Research for the years 1971-75. It is to be based mainly on the material provided by the three national censuses of 1950, 1960 and 1970 and their comprehensive, comparative analysis. Two theoretical problems require to be solved and developed: the concept of the urban system and the simulation models of urban growth and of the spread of urbanization. Three subsystems are to be studied in detail: metropolitan areas, regional networks and local networks. In addition the programme includes the study of the role and func-

tions of the historical and traditional centres in the changed conditions of modern civilisation.

The programme is not limited to theoretical and methodological studies and the analysis of the present situation. The study of the past, i.e., the genesis of the present, and of the future, i.e., the prediction of coming changes, are also covered by this ambitious programme. We hope that it will advance our knowledge of the processes of urbanization and so enable us to plan better the future developments.

Institute of Geography PAN, Warsaw



## THE ROLE OF FUNCTIONAL SPECIALIZATION OF CITIES IN THE FORMATION OF A SETTLEMENT NETWORK

MAREK JERCZYŃSKI

### INTRODUCTORY REMARKS

The advancing division of labour produces increasingly complex forms of social organization. Of particular importance in this respect are urban organisms, in which the division of labour attains its most advanced stage. This circumstance, which is characteristic of different domains of social and economic life, has significant spatial implications.

Within urban geography, the problems of the spatial division of labour are considered in investigations of the functions of towns, especially the functional specialization of cities. In recent contributions by Dziewoński [9], Garner [14], Murphy [26], Smith [29] and Wróbel [34] functional classifications of towns are subjected to much criticism. A major point of dispute is that the majority of classifications do no more than merely identify a definite number of urban centres, not always marked by similar features, and describe them. Many authors think that advance in these investigations could be achieved by passing from the identification of types of urban centres to an analysis of the spatial patterns they constitute and to the space-functional relations established between them. Such opinions have also been frequently expressed in Poland, mainly by Dziewoński [7, 8, 9, 10, 11].

The essential points of the functional approach are well illustrated by the hypothetical model of an isolated and integrated urban society presented by Webb [33]. This model considers the function of the urban centre from two points of view. Firstly, this function is treated as a definite kind of economic activity within an individual urban unit. Secondly, the function is viewed in its spatial aspect, indicating the character of the town's links with the outside world. There is a close interdependence between the kind of activity and degree of differentiation of the structure of a town and its role in the system of spatial relationships. The specialization of the particular urban units lead to their integration, which in turn, produces the system of cities. The model of socio-economic space is marked by evolution from less to more integrated structures.

This approach to the analysis of the functions of towns is based on the principle of integrating theoretical concepts which are usually treated separately. This integration proceeds between the most advanced concepts, in our case between that of urban economic base (functional structure) and the theory of central places. It ought to be emphasized that so far there have

been few attempts to make comparative analyses at a macroscale and for a large number of objects.

This study attempts to discuss these problems and to present an analysis of them with the example of Polish towns. Because of the diversity of the notions, concepts and methods employed, and in view of the fact that this study has not yet been completed, these problems can be presented in only a simplified form. The fundamental task of this study is to determine:

- the trend of the changes in the function and structure of present-day Polish urban centres,
- the extent to which Polish towns are integrating into a more coherent whole (system of cities).

The analysis was based on a group of 79 administratively defined towns. In this group, 5 towns have the status of voivodship (province), and 74 are town *poviats* (status corresponding to county); among the latter, 12 town *poviats* are also the seat of voivodship authorities. The fundamental unit of measurement used in this study is employment according to place of work (including commuters). The materials were taken from the following sources: for services, agriculture and construction — Balances of Manpower (*Bilanse Siły Roboczej*), for the various branches of manufacturing — data obtained from the Central Statistical Office, Department of Industrial Statistics. Altogether the classification used comprised 30 activities. Because of difficulties in obtaining comparative data for longer periods, the analysis of change covers only the 5-year period 1960 to 1965.

#### THE URBAN ECONOMIC BASE AND INDIRECT METHODS OF MEASUREMENT

The first step in the analysis was a division of the town's economy (employment) into two groups; the exogenous (the urban economic base) and the endogenous. For this purpose, indirect methods of measurements were used, namely the "minimum requirements" method and the method of "index of surplus workers," which is a modification of the location quotient. In each

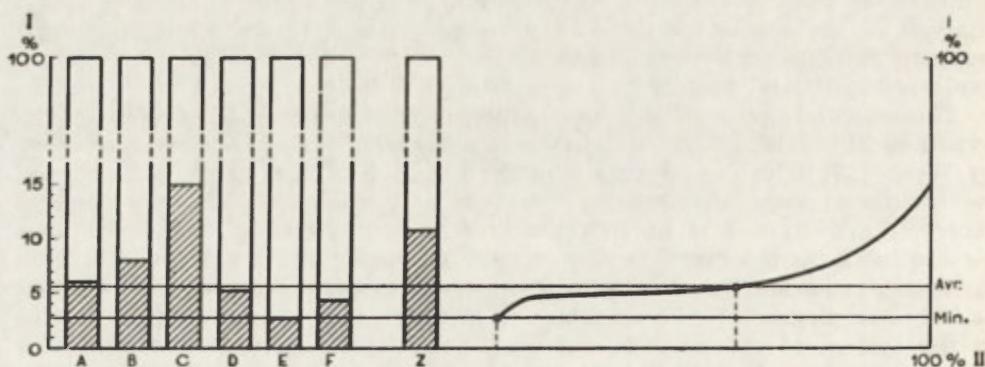


Fig. 1. A scheme illustrating the principle of the indirect methods of measurement of the urban economic base

I — the share of employment in a given activity (percentages); II — the set of urban units ordered in a sequence from the smallest to the highest percentages of employment in the given activity; A, B, C, D, E, F, ... Z — individual urban units; Min. — the minimum percentage of employment in a given activity in the examined set of urban units determined by the minimum requirements method; Avr. — the average percentage of employment in an activity on national scale assumed as a normative value in the method of the surplus workers index

TABLE 1. Percentages of employment considered necessary for the local consumption of an urban centre, as determined by the minimum requirements method and assumed in the index of surplus workers (31 December, 1965)

Activity	Minimum requirements method ( <i>k</i> value*)		Method of index of surplus workers (national values)
	79 towns	63 geographically separate towns	
Agriculture and forestry	3.6	4.2	44.2
Services — total	16.6	18.5	23.1
Transport and communications	2.2	4.2	5.4
Commodity turnover	4.4	4.7	5.3
Municipal services and housing	3.8	3.8	1.9
Education, science and culture	2.5	2.3	4.0
Public health, social welfare, and physical culture	2.3	2.0	2.5
Administration, law, political and social organizations	0.9	1.0	2.3
Insurance and religious institutions	0.2	0.2	0.5
Other services	0.2	0.3	1.2
Industry and construction — total	7.1	7.3	32.7
Construction	4.2	4.2	6.0
Generation of electric and thermal power	0.0	0.0	0.5
Fuel industry	0.0	0.0	2.8
Ferrous metallurgy	0.0	0.0	1.1
Non-ferrous metallurgy	0.0	0.0	0.3
Engineering and metal goods, transport equipment, metal industry	1.0	1.0	6.8
Electrotechnical industry	0.1	0.1	1.3
Chemical industry	0.0	0.0	1.3
Rubber industry	0.0	0.0	0.2
Building materials industry	0.1	0.1	1.4
Glass industry	0.0	0.0	0.3
Porcelain-earthenware industry	0.0	0.0	0.1
Timber industry	0.2	0.3	1.5
Paper industry	0.0	0.0	0.3
Printing industry	0.0	0.0	0.3
Textile industry	0.0	0.0	2.7
Clothing industry	0.3	0.4	1.2
Shoe and leather industry	0.1	0.1	0.9
Food industry	1.0	1.0	3.2
Salt industry	0.0	0.0	0.0
Other branches of industry	0.0	0.0	0.3
Total	27.2	30.0	

\* For agriculture and municipal services and housing average values have been taken

of the two methods the actual urban structure is compared to that adopted as a "model". The differences in defining this frame of reference constitute the differences between the methods (Fig. 1).

The minimum requirements method assumes that the employment necessary and, at the same time, sufficient for satisfying the internal demand of goods and services is secured by the minimum percentages of employment (if we consider cities of a given size and if we determine the necessary values for each activity separately). In the method based upon the location quotient average percentages are taken for such values (e.g., for the country or a region). Both methods presuppose an even and uniform model of output and consumption within the whole area examined. Exceptionally, in the method based on the location quotient, foreign trade is omitted and the country (or region) is treated as a system of a closed economy.

The normative values obtained for the particular activities by the minimum requirements method and the values taken in the index of surplus workers method show considerable differences (Table 1). The values obtained by the minimum requirements method are here considered from two points of view. In the first case all administrative units without exception have been taken into account (79 towns). The share of the endogenous group in the total employment calculated in respect of these data amounted in 1965 to 27.2%. In the second case the urban units with a close geographical situation were treated together, connected into complexes. As a result 63 geographically separate towns were obtained. The total value of the endogenous group calculated for this set of units amounted to 30%.

TABLE 2. The values of the endogenous group in 1960 and 1965 calculated by variants of the minimum requirements method depending on size of towns (in %)

Class of size (,000)	Absolute minimum values		<i>k</i> value		<i>k</i> value*	
	1960	1965	1960	1965	1960	1965
	2	3	4	5	6	7
> 300	50.7	51.3	50.7	51.3	52.9	53.5
100-300	44.1	47.1	44.1	47.1	46.3	49.2
50-100	24.5	24.1	24.5	24.1	28.3	28.9
< 50	19.7	21.1	24.0	25.0	29.0	30.9
Total for 63 cities	18.4	19.4	23.5	25.0	28.3	30.0

\* For agriculture and municipal services and housing average percentages of these activities in the given class of size were taken as normative values

The structure of employment taken as a frame of reference in calculating the value of the endogenous group by the index of surplus workers gives a total of 100%, for it corresponds to the structure of the country as a whole. The large differences of the two frames of reference result primarily from the considerable share of agriculture in the country's total employment (44.2% as compared to 3.6% and 4.2% given by the methods of minimum requirements). This means that in the index of surplus workers no urban centre attains this value. Considerable differences between the magnitudes of both structures

occur in the percentages of employment in manufacturing. The highest agreement of percentages can be observed in the case of services.

Also, the share of the endogenous group in towns of different sizes was calculated (Table 2). For this purpose, three variants of the minimum requirements method were used:

- (a) absolutely minimum percentages for given activities (Ullman and Dacey [30]);
- (b) percentages determined by the  $k$  value (Alexandersson [1]).
- (c) percentages determined by the  $k$  value, with a modification for agriculture and municipal services (for which average values have been adopted).

This last variant was subsequently used in calculating the endogenous group of individual towns.

The results show that there is a positive correlation between the sum of minimum percentages (identified with the endogenous group) and the size of the town. An exception is the group of urban units of 50-100 thousand population, whose total value of the endogenous group determined by the 5th percentile is lower than that of the group of towns of less than 50 thousand inhabitants. This is a consequence of the fact that the number of objects in this class — as well as in classes of bigger towns — is small and the  $k$  value actually determines the absolute minimum percentages (first urban unit in a row). Moreover, this small share of the endogenous group is also connected with the highly-specialized homogenous structure of employment of several urban centres. Each of the three variants of measurement show a growth of the endogenous group in the years 1960 to 1965.

The division of urban employment into endogenous and exogenous parts has also been made by means of the index of surplus workers according to the formula:

$$e_{xi}M = \left[ e_iM - \left( eM \times \frac{E_iK}{EK} \right) \right]$$

where:

- $e_{xi}M$  denotes excess employment (in absolute numbers), identified with employment of an exogenous nature in activity  $i$  in city  $M$ ,
- $e_iM$  employment in activity  $i$  in city  $M$ ,
- $eM$  total employment in city  $M$ ,
- $E_iK$  employment in activity  $i$  on a national scale,
- $EK$  total employment on a national scale.

The value of the index increases when the total employment in the city decreases. The total employment in the city plays here the role of the "weighting" factor with respect to the appropriate proportions of the national employment. The minimum limit value in the formula is expressed by:

$$\left( eM \times \frac{E_iK}{EK} \right)$$

It is assumed that this expression denotes the self-sufficient component of each activity, or, to put it differently, the value necessary for local consumption. An appraisal of the usefulness of this index for the measurement of the economic base of metropolitan areas is contained in the study by Matilla and Thompson [23].

A detailed discussion of the results obtained, throwing some light upon the properties of both indirect methods of measurement used here, is beyond the scope of this paper, which permits only a general presentation.

To compare the results obtained, the value of excess (exogenous) employment obtained by the two indirect methods have been summed up within each class of size, and their respective shares in the total employment of these classes of size have been calculated. For the year 1965 the following values have been obtained (in percentages):

Towns of population (,000)	Minimum requirements method ( <i>k</i> value)	Index of surplus workers method
More than 300	52.7	51.3
100-300	48.6	51.5
50-100	27.5	49.6
less than 50	28.7	48.0

These data show that the share of the endogenous group dependent on the size of the city exhibits higher variation in the minimum requirements method, for the frame of reference is each time determined individually for the given class of size of towns. In the index of surplus workers method the share of the endogenous group in the particular classes differs only slightly, which, in turn, is related to the adoption of one frame of reference for all of the urban units. These values also illustrate the growth of the endogenous group, together with the size of the urban unit. The somewhat lower share of the class of biggest units results from the fact that they include the highly specialized urban industrial agglomerations of Upper Silesia and Łódź.

The adoption of different frames of reference in the two methods results in different quantitative relations between the endogenous and exogenous groups in individual cities. In the minimum requirements method the structure of the endogenous group is identical, or very similar, in all urban units of a given size. The structure of the exogenous group is differentiated, and the mutual relation of both components of urban economy is constant or approximate (within a given class of size). The share of service activities in the endogenous group is in many towns similar or very approximate. Divergences are noticeable only in those units that are distinctly specialized in manufacturing. But considerable differences are exhibited in the particular urban units as regards the endogenous structure of manufacturing, for only a few attain the percentages of national employment. In effect, the large differences caused by the different structure of manufacturing activities and different values of agricultural employment contribute to the differentiation of the whole structure of the endogenous group.

The minimum requirements method disregards import activities of the urban unit and concentrates attention on exports (exogenous activities). The index of surplus workers method covers the whole model of the urban economy. The minimum percentages tend to diminish endogenous employment, whereas average values are almost in all cases higher than those established by means of direct measurement (Leigh [21]; McGovern [24]). It must be stressed that the minimum requirements method tends to diminish the endogenous group primarily in specialized activities, which have a sporadic model of spatial location. The reverse is true of the index of surplus workers, which for this same kind of activities shows proportions of endogenous employment that are too high. It was also observed that the values of endogenous employment include elements of an exogenous nature, although they have been determined by means of minimum requirements. Thus it ought to be expected that for a number of towns the respective values of endogenous employment in some services are overestimated not only by the index of surplus workers method but also by the minimum requirements method.

On the whole, both indirect methods respond in a similar way to a number of variables, including the size of the spatial unit of reference and the degree of branch aggregation of the data. In these methods the size of the endogenous group grows together with the size of the urban unit and decreases together with branch disaggregation. Incidentally, the set of recognized and conjectured factors affecting the size of the two groups of the urban economy is much more numerous. A number of these factors were taken as a basis for Ullman and Dacey's considerations. The dependence between the concept of economic base and that of population potential was pointed out by Wróbel [35].

#### THE DEGREE OF DIFFERENTIATION OF THE URBAN ECONOMIC BASE

The urban economic base consists of different kinds of activity. The significance of these activities is different from town to town, and finds its expression in the unequal degree of differentiation of the functional structure. The concept of specialization of urban functions, which reflects the above phenomenon, is used with many meanings and is established in different ways. Here, this question is disregarded; we confine ourselves to discussing one of its aspects only—the degree of differentiation of the functional structure. It has been established according to the formula (Amemiya, [2]):

$$\eta = \sum_{i=1}^n \left[ \frac{n}{n-1} \left( e_{xi}M/e_xM - \frac{1}{n} \right)^2 \right]$$

where  $n$  denotes the number of branches used in analysis,  $e_{xi}M$  means exogenous employment in branch  $i$  in city  $M$ , and  $e_xM$  stands for the total exogenous employment in the city.

Theoretically, maximum differentiation (heterogeneity) occurs when all branches within the town have the same proportions of employment. In this case the index equals zero. At the opposite extreme minimum differentiation (homogeneity) occurs in the case where total employment is concentrated in a single branch only. The index of structural differentiation then equals 1.

The results obtained exhibit a considerable disparity in the functional differentiation of structure of the particular urban units (from 45 to 825). The analysis of the indices with a number of variables shows that a diversified functional structure is connected with the size and age of the urban unit, and is typical mainly of units of a service character with a relatively isolated spatial location. The most uniform functional structure was observed in the smaller towns with a predominance of manufacturing.

A comparison of the values of indices for the rather short period 1960 to 1965 showed the growing role of specialization in the exogenous structure of Polish cities. Out of the 79 towns examined, 19 exhibited changes towards a higher diversification of structure ( $\eta > -10$ ), in 19 the indices were approximate ( $\eta < \pm 10$ ), and in 41 urban units changes towards a higher specialization of the functional structure were observed ( $\eta > +10$ ). These results diverge slightly from those obtained in the measurement of the degree of differentiation of employment structure for an analogous set of urban units in the same period. The values of indices of employment structure led to the opinion that the diversification of the larger towns in Poland is growing in importance (Jerczyński [20]). It seems that these facts cast a new light on the nature of specialization of urban functions and its variability as dependent on the structure within which it is analysed.

## THE CENTRAL PLACE AND THE SPECIALIZED CENTRE

A more difficult task than the identification of the kinds of activities constituting the urban economic base is the identification of the areas on which these activities are performed. The materials at our disposal do not allow the identification of such areas. But it is possible to establish indirectly the character of the functional-spatial relations of the particular urban units.

The kind of activity constituting the urban economic base was used by Harris and Ullman [16] to distinguish three categories of urban centres:

- Cities as central places,
- Transport cities,
- Specialized-function cities.

Each of these types has specific spatial links with its environment and a definite pattern of spatial location.

The fact of fulfilling such a complex of functions for the surrounding area refers in particular to the towns of the central place type, and only to a smaller extent to the remaining two categories. From this point of view, the proposed division can be reduced to a dichotomous juxtaposition by opposing the town of the central place type to that of the specialized centre. In the former case, the urban functions are continuous in their character, constituting limited spatial patterns, and their structure is hierarchical. In the case of the specialized centres, the functions are of a non-continuous character, they constitute spatially unlimited patterns and at the same time they contribute to the integration of the settlement network on a macro-scale.

The existing towns are combinations of these types, performing to a certain degree functions of both a central and a specialized nature. Thus, the question as to whether cities integrate and grow into a more coherent system can be answered by measuring the reciprocal relation of the two functions within one city. The growth of differentiation of the urban functional structure and a higher level of employment in manufacturing activities as compared to services suggests that the functions of the specialized centre perform a dominant role in the development of Polish towns. This hypothesis is justified through measurement of:

- (a) The frequency of occurrence of a given category of activities in the functional structure of the group of urban units examined,
- (b) The deviations from the average values of exogenous employment in each category of activities.

Specialization in this context is here considered horizontally. A more correct solution of this problem would additionally include the analysis of vertical specialization (depending on the size of the urban unit). In this study such an analysis has not been made because of the small number of larger urban units. This is undoubtedly a limitation of the results obtained.

Methodologically, this approach is similar to that of Illeris [19]. The percentages of exogenous employment in each of the 30 activities in all urban units examined have been ordered from the lowest to the highest values and presented in diagrams. However, in measuring the variation of the magnitudes analysed the index proposed by Morrisett [25] and used by

Illeris  $\left( \frac{95 \text{ percentile}}{50 \text{ percentile}} \right)$  has been abandoned. True, the advantage of this index is the ease of calculation, but, since it is based on two values only, it does

not say very much about the actual dispersion of data. Therefore measurements of the deviations of exogenous employment from the average values were made by the standard deviation  $\delta$  and the spatial variation coefficient  $V$ , where:

$$\delta = \sqrt{\frac{\sum (e_{x_i}M - \bar{e}_{x_i}M)^2}{N}}, \text{ and } V = \frac{\delta}{\bar{e}_{x_i}M}$$

The analysis made possible the identification of three types of activities (functions):

- (a) The ubiquitous type — these activities occur in all, or nearly all urban units of the investigated set of objects; the percentages of exogenous employment do not exhibit high variation in the particular centres. We assume that, in spite of possible supraregional relations, the fundamental market for these activities is the region.
- (b) The sporadic type — these activities occur in only a few urban units of the group examined; the percentages of exogenous employment exhibit high variation in the particular centres. We assume that, in spite of possible regional relations, the fundamental market for these activities is supraregional.
- (c) The mixed type — these activities have features of both the ubiquitous and the sporadic types. They occur in the majority of urban units examined but the percentages of exogenous employment for some centres exhibit higher values than for others. These activities are marked by relations of both regional and supraregional character.

The calculation of the regional and the supraregional component within mixed activities is the most difficult element of the whole analysis. Attempts to solve this problem by statistical operations, i.e. by determining the degrees of ubiquity and infrequency of the mixed activity, proved to be unsatisfactory. To solve this difficulty, additional materials and studies had to be used. In the case of activities for which more detailed statistical materials were at hand than for the used in the analysis (e.g. by branches) the measurement of the degree of ubiquity and of infrequency has been repeated and in this way the required values were obtained. Unfortunately, because this type of data was unavailable for several categories, the required ratio of regional to supraregional employment had to be stated arbitrarily by using studies dealing with this problem directly. This made possible the calculation of the total regional and supraregional values of employment and their ratios in the particular urban units.

The results obtained showed that the supraregional elements predominate decisively in the functional structure of most urban units examined. In 63 urban units with a relatively isolated geographical location the share of exogenous supraregional employment in the total exogenous employment was as follows (1965):

$e_{x \text{ s-r}}M / e_{x \text{ total}}M$ (in %)	Number of urban units
< 60	21 (of which < 50%—12 units)
60–80	13
> 80	29

The value of exogenous regional employment can be used in measuring the “centrality” of the urban units and in defining their hierarchy. But, as has been mentioned before, since in the minimum requirements method the values of endogenous employment contain also exogenous elements, it seems

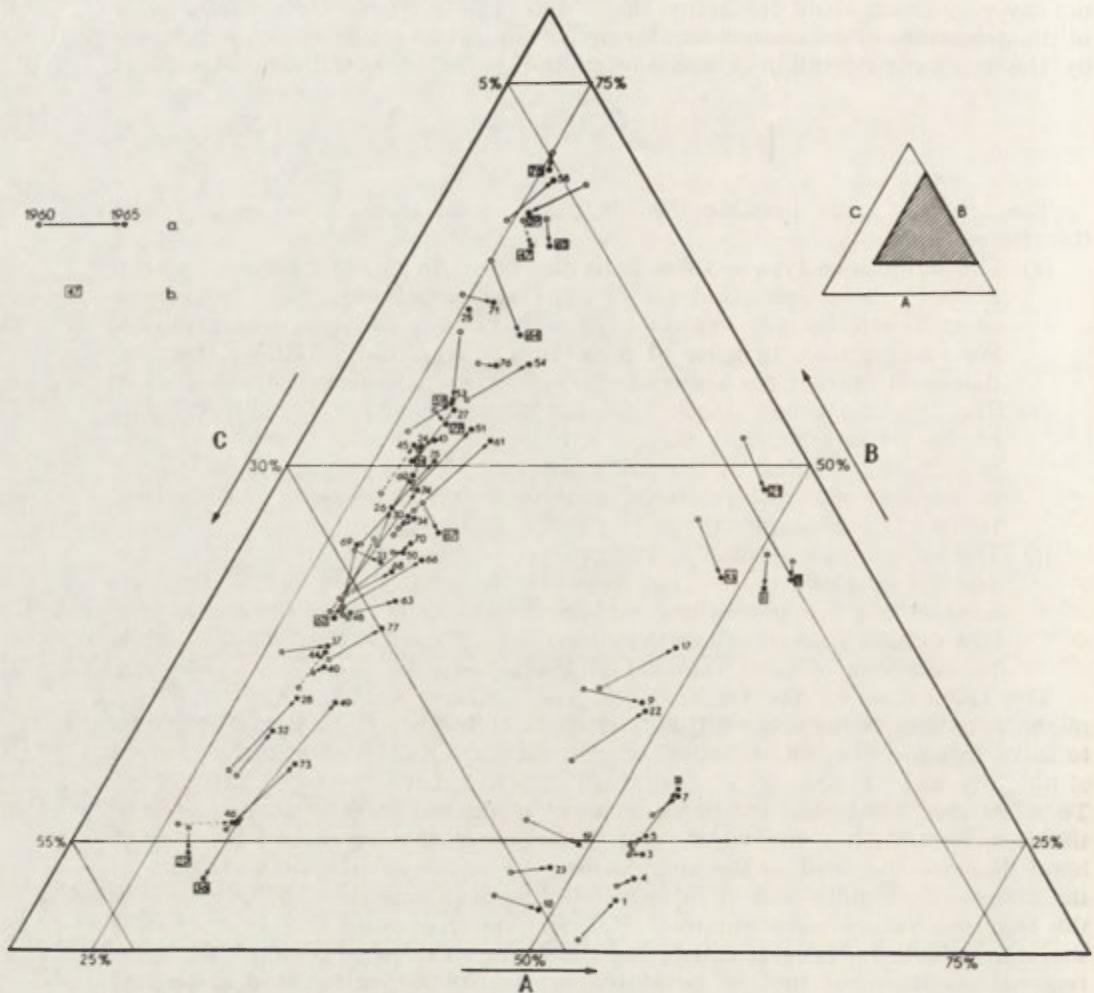


Fig. 2. The changes in the spatial system of urban units in 1960 to 1965 by their proportions of employment in the following sectors: endogenous (A), exogenous supraregional (B), and exogenous regional (C)

a. changes in the location of urban units within the period discussed; b. urban units that increased their share of exogenous employment of a regional character in the period discussed  
Cities examined, 1965

- |                   |                          |                             |                        |
|-------------------|--------------------------|-----------------------------|------------------------|
| 1. Warszawa       | 27. Kalisz               | 46. Koszalin                | 65. Skarżysko-Kamienna |
| 3. Kraków         | 28. Opole                | 47. Tomaszów Maz.           | 66. Tczew              |
| 4. Wrocław        | 29. Olsztyn              | 48. Inowrocław              | 67. Racibórz           |
| 5. Poznań         | 30. Legnica              | 49. Przemyśl                | 68. Siedlce            |
| 7. Szczecin       | 31. Grudziądz            | 50. Gniezno                 | 69. Chełm              |
| 9. Bydgoszcz      | 32. Rzeszów              | 51. Ostrów Wlkp.            | 70. Leszno             |
| 10. Lublin        | 33. Włocławek            | 53. Świdnica                | 71. Zyrardów           |
| 13. Częstochowa   | 34. Gorzów Wlkp.         | 54. Ostrowiec Świętokrzyski | 73. Zamość             |
| 17. Radom         | 36. Tychy                | 58. Starachowice            | 74. Brzeg              |
| 19. Białystok     | 37. Zielona Góra         | 59. Pruszków                | 75. Nysa               |
| 21. Wałbrzych     | 39. Jaworzno             | 60. Piła                    | 76. Zduńska Wola       |
| 22. Toruń         | 40. Słupsk               | 61. Otwock                  | 77. Zakopane           |
| 23. Kielce        | 43. Piotrków Trybunalski | 62. Rybnik                  | 78. Stalowa Wola       |
| 24. Elbląg        | 44. Piock                | 63. Nowy Sącz               | 79. Cieszyń            |
| 25. Bielsko-Biała | 45. Jelenia Góra         | 64. Zawiercie               |                        |
| 26. Tarnów        |                          |                             |                        |

- I. Upper Silesian Urban Complex  
 II. Łódź Urban Complex  
 III. Gdańsk Urban Complex

to be safer to treat endogenous employment in conjunction with exogenous regional employment as the more adequate measure: ( $e_{\text{end}} + e_{\text{x reg.}}$ ). A comparison of this magnitude with the population number of the urban unit shows that in a number of cases the size of the urban unit does not match its role as a central place. The data of population number, endogenous employment + + exogenous regional employment, plotted in the diagrams according to the rank-size rule have also revealed the great significance of administration in the formation of regional patterns. In the case of the population number, the last among the seats of voivodship authorities (Koszalin) takes the 35th place. But if we consider the total value of both endogenous and exogenous regional employment this town climbs to the 23rd place. When exogenous regional employment is considered the first eighteen places in succession belong in this case to seats of voivodship authorities. The only urban unit to take a higher place than two voivodship capitals (Zielona Góra and Koszalin) is the town of Tarnów, a centre of considerable regional importance in the south-eastern part of the country (Dziewoński and Jerczyński [13]).

Most interesting was the comparison of the values of exogenous employment of regional and supraregional character made for the particular urban units for the period of 1960–1965. The results of this comparison are presented in a triangular diagram in which the sides denote respectively the shares of: endogenous, supraregional exogenous, and regional exogenous employment (Fig. 2). The dots represent the particular urban units, and the arrows indicate their displacement in the period under consideration. The fundamental conclusion from this analysis is the statement of the particular role performed by functions of an exogenous supraregional character. Within the group of 63 units examined, only 16 increased their share of regional employment. For the remaining 47 urban centres, the further specialization of supraregional functions was the leading factor. It ought to be observed that, cut of the 16 urban units with a tendency to increase their share of regional employment, most centres exhibited in 1960 very high values of supraregional employment (these units are represented by the dots in the upper right part of the triangle):

$e_{x \text{ s-r}} M / e_{x \text{ total}} M$  (1960)  
(in %)o

< 60  
60–80  
> 60

Number of units which increased their share of exogenous regional employment in the total exogenous group in 1960–1965

2  
5  
9

Special mention is due of two urban units that, in spite of their high share of regional proportions in the first stage of analysis, exhibited a further tendency to its increase. These were Tychy, a town built in the 1950's as a housing centre for the workers of the neighbouring Upper Silesian Industrial District, and Olsztyn, an important regional centre and seat of the voivodship authorities.

## CONCLUSIONS

The statistical data obtained in this study by indirect measurement methods are approximate. But the manner of calculation, which is analogous for all centres, means that the extent of possible error is distributed over all the objects analysed. Nevertheless each of the particular stages of analysis, for

which a number of simplifying assumptions have been made, requires additional remarks to make them more accurate.

A detailed inquiry into the influence of the group of factors on the magnitude obtained in the measurements of the urban economic base is indispensable. A number of additional empirical studies must be carried out in order to answer the questions as to what degree of aggregation is most adequate for the given method, which is the relevant spatial unit, how to solve a number of other problems of a technical nature, and finally, how to interpret the results obtained. For, the results obtained so far are not satisfactory, and an uncritical application of formal methods leads to a distortion of the phenomena analysed. In this case it is important to verify the data, the only reliable source still being direct observation. It is also by direct observation that the priority in identifying the economic base should be attributed to one or another of the indirect methods (Pratt [28], Ullmann [31]).

We must also develop a method by which one might distinguish objectively — and, at the same time, in accordance with reality — between the regional and supraregional elements in functions of a mixed character. In view of the growing specialization of services and because many branches of manufacturing exhibit elements of ubiquity, such a distinction will, however, be fraught with increasing difficulties. In this context it is imperative to treat critically those classification that are made on the principle of dividing all activities into services and manufacturing only.

The calculation of the share of regional and supraregional employment in each town furnishes only indirect information on the spatial links of the urban centre with the external world. These data may enable us to infer whether the town is more closely connected with its own region or with other regions, but they say nothing about the true spatial attributes of these relations. It is also important to disclose the actual links between centres, and to compare them with the results obtained by statistical inference. But, if endogenous employment, together with exogenous regional employment, is treated as the measure of "centrality", it is possible to measure the theoretical sphere of gravitation of the particular urban units, using for this purpose potential models (Chojnicki [4]).

The overall aim of studies of urban functions ought to be the determination of the interrelationships between the type of functional structure of the particular urban units and the place of these units in the system of spatial links.

The growing importance of functions typical of specialized centres, functions that are a factor of interregional integration, leads to the formation of a system of cities. This, together with the observed lack of clear correlation between the size of a town and its role as central place, also indicates the necessity for modification of the current theory of settlement networks. This theory, which so far has been based mainly on the principles of the concept of central places, should be enriched by the concept of a system of urban centres. The system approach has been winning ground in contemporary geography (Chojnicki [5]; Chorley and Haggett [6]; Haggett [15]; Harvey [17]; *Soviet Geography* [22]). The number of its users and propounders in urban studies is growing too (Berry [3]; Dziewoński [12]; Hoover [18]; Pitts [27]; Wärnerød [32]). But, as a relatively recent concept, it requires further deepening of theoretical assumptions and further development of analytical methods.

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## URBAN SPATIAL GROWTH: A WAVE-LIKE APPROACH

PIOTR KORCELLI

### INTRODUCTION: THE WAVE ANALOGUE

The territorial expansion of urban areas is a problem of urban-rural interaction which has been frequently studied during the past decade. The application of simulation models to the analysis of urban growth and development has received particular attention. Many of the methodological questions pointed out by Garrison [8] have been solved. Morrill ([25], p. 1) suggests, however, that most research has been directed to the better specification of microscopic models, while explorations into more general parameters of spatial diffusion have been much less numerous. In such macroscopic studies the techniques used by Morrill [23, 24], W. A. V. Clark [7] and C. C. Harris [14] for detailed analyses are often found inept. Therefore, instead of attempting to reproduce the actual course of events one may proceed by calling upon a general process well recognized in some other research discipline. One of the possible approaches is to employ an analogue of wave motion.

In this context the credit should be given first to Blumenfeld [2], who as early as 1954 made, on the basis of empirical data for population growth and density in the Philadelphia region, an explicit comparison between the process of metropolitan expansion and a tidal wave. He noted that within individual concentric zones both the direction and variations in rate of change follow in an orderly fashion. In addition to this Blumenfeld found a general tendency for the zone of maximum increase to move towards the edge of the area. The last finding might have been regarded as trivial had it not been supplemented with secondary considerations relating to the height of the crest and the influence of business cycles.

The wave-like concept of urban growth was re-studied in the late 1960s. R. Boyce [4] pointed out the occurrence of three types of wave: recession wave, precession wave, and the cutting edge of the metropolis. He drew some more direct comparisons between the behaviour of ocean waves and the surface of the city. Leaving most of his questions unanswered, Boyce made a call for attempts to abstract and dissect the single waves rather than to simulate directly the entire urban surface, which had been the approach of earlier simulation studies.

Since urban growth can be regarded as a diffusion phenomenon, the waves of innovation diffusion, recognized first by Hagerstrand [13], have their counterparts in urban growth waves. This has been an implicit argument in recent work by Morrill [25]. Besides discussing the wave formula and parameters,

Morrill has demonstrated both the similarities and the differences between the spread of the true wave-like phenomena, and those of interactional character. He has also refined the earlier schemes of sequential diffusion waves in the settlement development context. Some of his specific points will be treated in a later section of this paper.

The present author's work on the subject has led to the construction of a graphic model [19], which subsequently has been developed into a more rigorous form [20]. The model is composed of six successive stages. In the first stage the growth based upon the premises of a transportation surface and monocentricity produces a pattern comparable to a scheme of harmonic motion. Subsequent versions introduce by wave asymmetry the concept of human succession, with its characteristic phases of penetration, invasion, consolidation, and saturation. Next, variations in rates of growth for the whole area, differentiations in the attractiveness of individual subareas, policentricity and, finally, the sequence of growth cycles are considered.

A new stimulus to the development of a wave-like concept of urban growth came from the expanding literature on time series and spatial series analyses (see, for example, Granger [10]). Since some of the methods, like spectral analysis, have a built-in wave component, their successive application to the study of urbanization processes might be regarded as strong evidence for the wave theory of urban growth. Such a judgement, however, would be premature, as data on various processes of a non-wave character can be fitted quite effectively to the physical diffusion formula. Recently the techniques have been used by Tobler [30, 31] in an analysis of population distribution and density, on both inter- and intra-urban scales. It should be admitted that the conclusions he draws are statistical rather than theoretical.

One more analogy between the city and a system of waves is given by Gokhman, Gurevich and Saushkin [9] in their article on metageography. They noted a similarity in the structure of Clark's formula of urban densities and the formula describing the system of trochoidal waves. An exchange of parameters would allow for comparison of these two "totally different geographical entities".

When discussing the role of analogies in geography, Wilson [32] emphasises both the usefulness and the dangers involved in their application. When a formal concept is borrowed from another science, it has to be reinterpreted for its new use. Such attributes as "validity" or "degree of belief" cannot be transferred alongside the theory. A similar view is expressed by Olsson [27]. Referring to Tobler's study, Olsson points out that the same model can often describe both a physical and a social system, while the causal and substantive interpretation may differ. Tobler's analogy is still "more formal than substantive, and the model, therefore, is predictive rather than explanatory" (Olsson [27], p. 221).

Considerable material has accumulated dealing with urban spatial growth and its analogies. The time seems ripe to attempt a more systematic confrontation of the postulates of the wave theory with those of the existing theory of urban growth and structure.

## WAVE ANALOGUES AND URBAN SPATIAL GROWTH THEORY

As a starting point it is useful to review briefly some of the leading approaches to the investigation of the urban spatial growth process.

- (1) The ecological school of urban studies, the most productive one in the

past, and still viable, has contributed to the wave-like concept in at least two ways. Firstly, ecological studies use the notion of a succession cycle, which can be compared to the passing of a wave, with all its consecutive phases. Secondly, some studies establish the idea of the population capacity of an area as a value marking the accomplishment of a given process (cf. Hudson [18], which, in the innovation diffusion theory, might be defined as the maximum acceptance level.

(2) The "suburbanization school" may be regarded as another "traditional" approach to the urban spatial growth process. Such authors as Hawley [16], Bogue [3], and Schnore [29] emphasized the ascendancy of the dispersive over the cohesive forces, resulting in the peripheral development and a simultaneous decline of the city centre. This conforms to the wave-like concept when supported by the notion of an outward move of both the maximum and the minimum growth zone. It may be conceived of as a fragment of the moving single wave. The remainder may be added if the most likely pre-crest situation also is considered.

(3) The sequent occupancy concept has been used in only a few studies of urban growth. When first developed in the 1920s the concept referred to the evolution of the cultural landscape. Similar methodology, however, has been applied much later in at least two works that formulate important generalizations about the pattern of urban-metropolitan growth. These are the studies by Hoover and Xernon [17] and Griffin [11]. In both studies the growth process is interpreted in terms of a sequence of distinct stages. The duplication of the pattern in zones increasingly distant from the centre is identified, and implicit assumptions of periodicity are made.

(4) Urban population density models are a well-developed branch of urban research and numerous new studies on the subject can be found in the literature. The most often quoted are the works by Clark [6], Berry, Simmons and Tennant [1], and Gurevich and Saushkin [12], while further extensions of the concept have been presented by Casetti [5], Kostrubiec [21], and Newling [26]. The paper by Newling is especially relevant in the present context, since it considers the urban densities in a dynamic framework. The evolution of the density pattern is viewed by Newling as a one-cycle process.

(5) Spatial diffusion studies have been used by numerous authors to investigate urban growth processes. In his exposition of simulation techniques in urban research Garrison [8] suggested that a diffusion-type model of urban growth and development should include three basic groups of elements. These are: firstly, grid elements which account for the spatial continuity of the process, following the proximity principle; secondly, system-wide elements operating in accordance with specific rules but producing a unity of area; thirdly, external elements representing the relations with a broader universe. The operation of all these groups of elements can be readily reinterpreted in the framework of the wave-like analogue model. In the wave motion kinetic energy at one point is transferred to potential energy at an adjacent point and so on; thus an equivalent of the "contagious process" is produced. The operation of system-wide elements may be represented in a wave analogue in a more general way than in a classic simulation model. Here the system may be interpreted as an area over which the process of change takes place, and an alteration at any point may be viewed as a predictable consequence of the overall direction and rate of change. Finally, the external elements are those regulating the system inputs, which influence the parameters of the waves.

This review refers to only one type of urban growth model, namely those primarily concerned with redistribution of population within a metropolitan area. Consideration of other kinds of urban development models, like those dealing with social and economic characteristics of population, changing land-use patterns, the planning process, transportation, and the social, economic, and political institutions of cities, is beyond the scope of this paper. Incidentally, it is doubtful whether they all could be treated under a single heading and, if they were, whether any meaningful generalizations could be arrived at. With these reservations in mind it seems permissible to conclude that the existing theory of urban-metropolitan spatial growth, as represented by several leading approaches, is not only in accord with, but even implies the recognition of, a wave-like character of urban growth.

The explanatory role of the wave-like concept is subject to some limitations. The concept itself takes for granted that the city exists and that it receives population. Therefore, it disregards a part of what Leven [22] defines as the urban process. When developed, however, the approach should not only determine the growth pattern, but also identify the factors that account for the formation of the city.

If the urban growth should be defined as a wave-like phenomenon, then it would have to refer to the most general notion of a wave, rather than to any of its particular types. The simplest form of a wave, that of harmonic motion, is given by the formula:

$$X = A \sin 2\pi f t$$

where  $X$  is vertical displacement of a point;  $A$  is wave amplitude;  $f$  is wave frequency; and  $t$  is time.

In fact, all kinds of waves as recognized in physics, for example electromagnetic waves, sound waves, hydrodynamic waves, and vibration waves, have profiles described by more complex formulae. The behaviour of the urban waves, however, is still more complex. Even with all the simplifying assumptions made relating to the nature of the environment, economic standards, and the decision-making process, the wave form does not meet the following rules which are obeyed by waves in physics.

*General to all kinds of waves:*

A. Transmission of energy takes place with no net transport of the material of the medium;

*Particular to certain kinds of waves:*

B. Frequency is constant, with constant intensity of propagation;

C. Velocity is determined by the properties of the medium.

The first discrepancy is self-evident. The second results from the fact that the successive waves carry different substances. The third is a consequence of the role of impact, which determines the rate of advance of a particular wave. This holds true irrespective of whether we stipulate that the medium consists of population or of a type of occupancy. The origin of the disparities is obvious. The intricacy of social processes cannot be matched by those of physical phenomena and, therefore, in drawing analogies between the two types of occurrences utmost care must be taken.

For representing the urban spatial growth process in its most general form the following expression is proposed:

$$I = f(p, c, R)$$

where  $I$  is rate of population increase for individual zones and time intervals; the variables  $p$  and  $c$  denote phase and cycle, respectively; and  $R$  is local

resistance. An operational formula, in addition to employing specific parameters, would also have to include some supplementary variables, like those accounting for fluctuations in regional growth rates, and to consider the influence of two or more wave-generating centres.

PROBLEMS OF THE WAVE ANALOGUE APPROACH

This section aims at providing some examples and a more detailed treatment of certain notions which have been put forward above. The problems are categorised and considered under seven headings.

(1) *Kind of data.* The process of population growth and redistribution within a metropolitan area can be represented graphically in several ways. Two

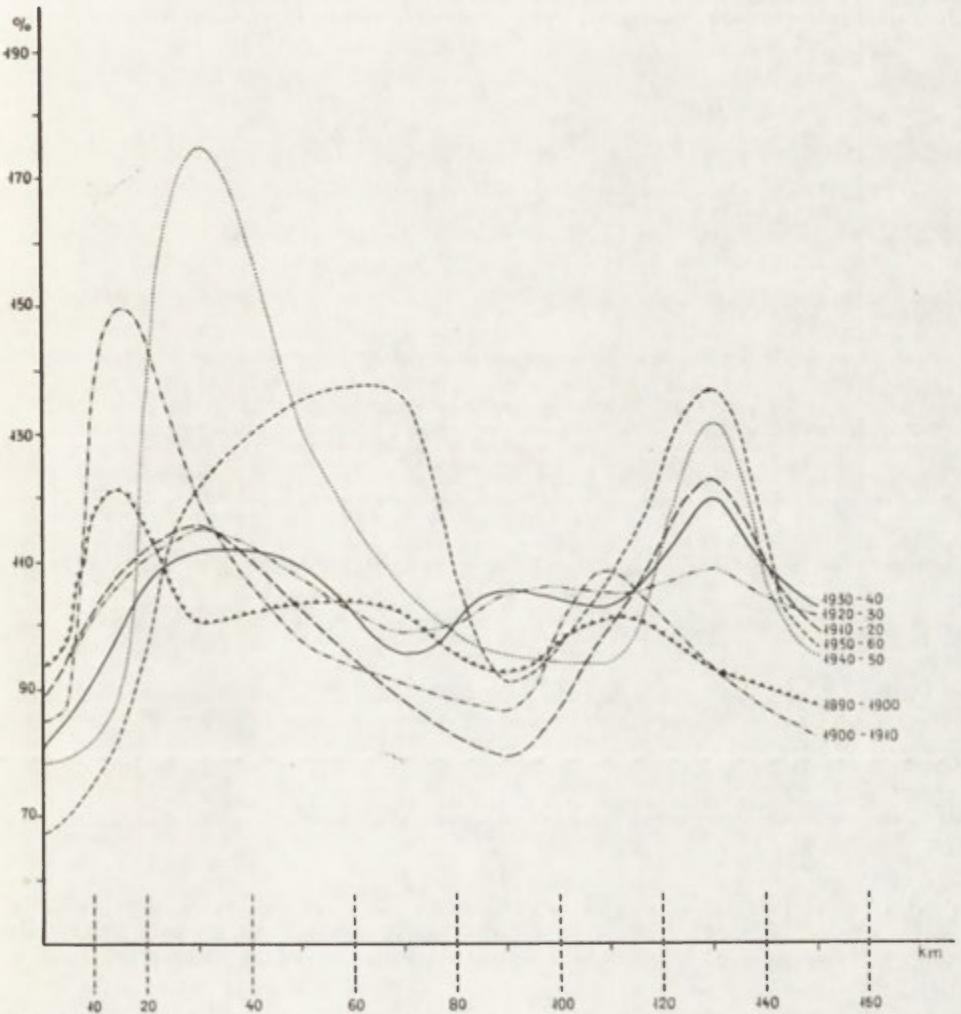


Fig. 1. Relative population increase by concentric zones (area mean = 100). San Francisco Region, 1890-1960

methods have been applied most often — density profiles and curves showing relative population increase. The latter method has been used in constructing Fig. 1 and 2, in which the rates for individual zones are adjusted to the regional trends by fixing the coefficients for the whole area as constant and equal to 100. For illustrating the evolution in types of occupancy Morrill [25] proposed a cumulative diagram with the proportion of land in various uses plotted on the ordinate. Another possible representation of the urban growth process, by means of a diagram showing percentages of population living in particular zones, is given in Fig. 3. Each method yields different parameters and velocity

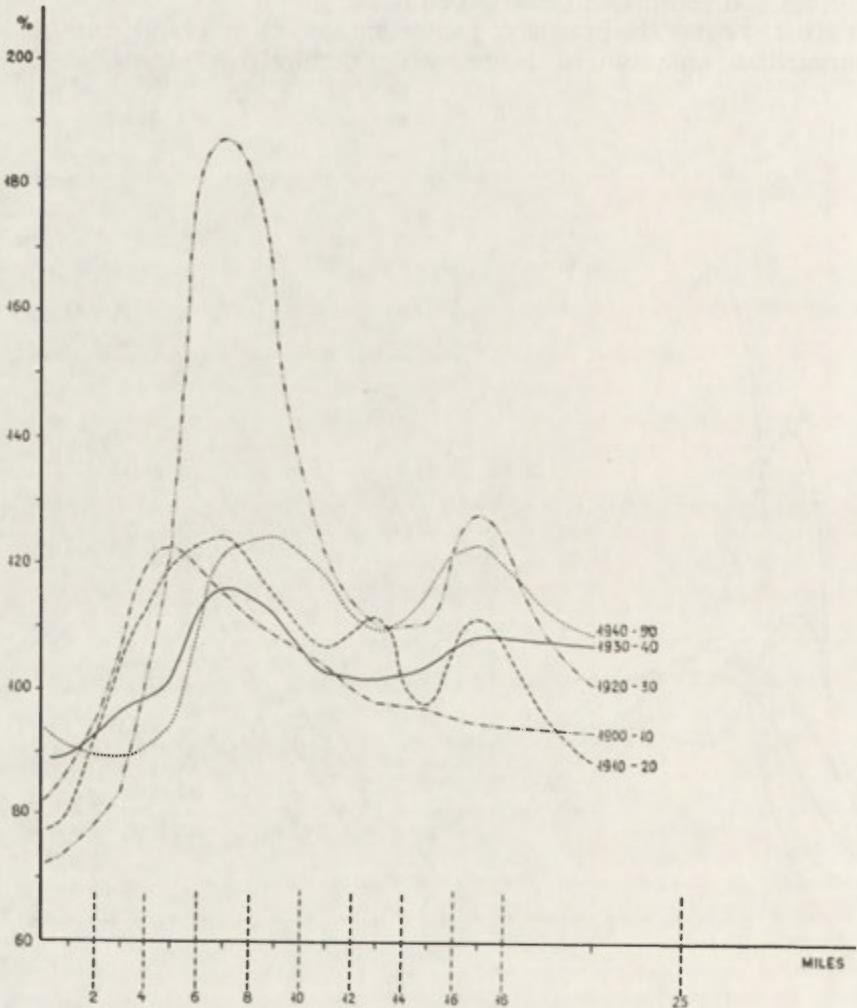


Fig. 2. Relative population increase by concentric zones (area mean = 100). Philadelphia Region, 1900-1950 (Modified from: H. Blumenfeld [2])

of change. For empirical studies the relative increase curves (Fig. 1 and 2) are preferred, as they allow a better identification of individual waves. However, in estimating the extent of successive cycles, density profiles are

very helpful. The spatial scale poses still another problem. Comparison between Fig. 1 and 2, even with allowance being made for interregional differences, indicates that the size of areal units greatly affects the results obtained.

(2) *Nature of time.* Urban development is a secular process, and metropolitan growth waves, as compared to the conventional kinds of waves, are rather exceptional in their low frequency and long periods. Boyce [4] claimed that fifty years were required for an upward and downward movement to occur in a zone. This is in accord with findings for California metropolises, but at a more detailed areal scale faster rates of transition may be observed (Korcelli

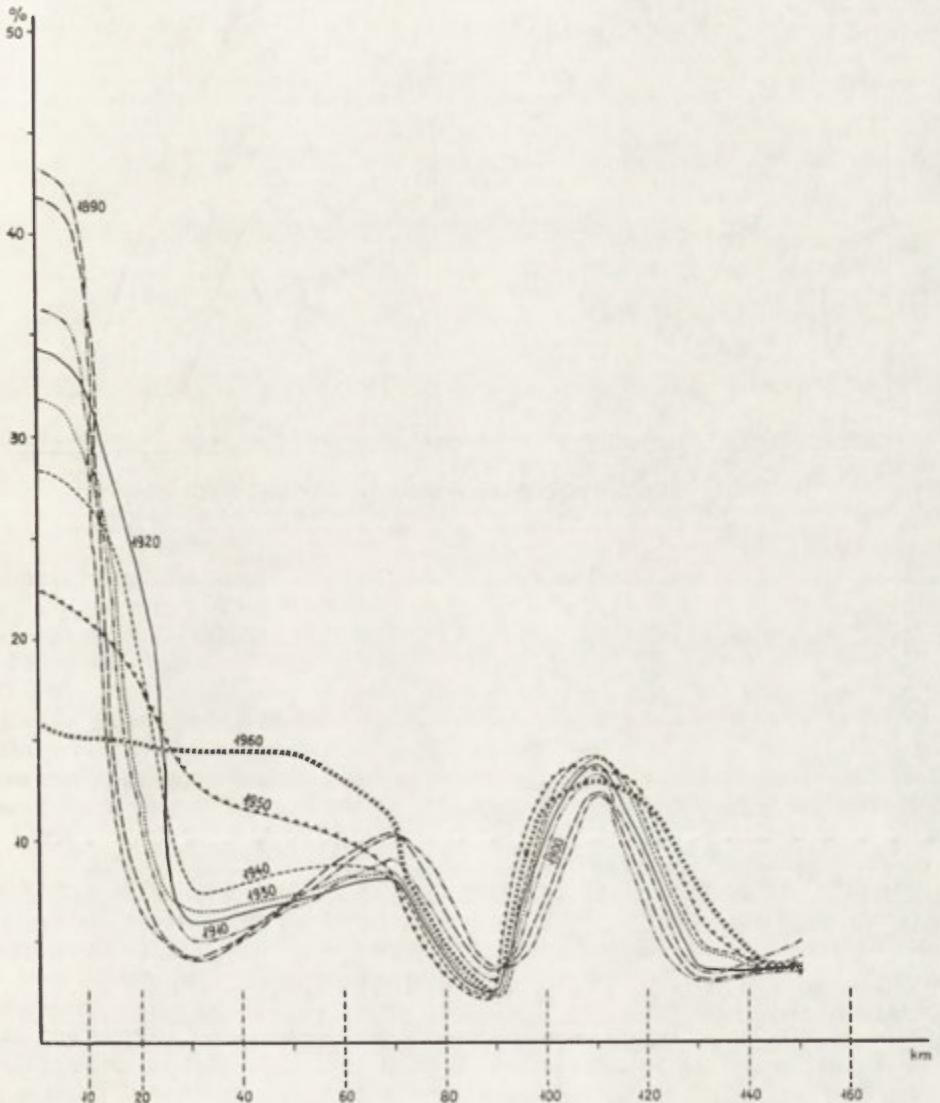


Fig. 3. Share of individual concentric zones in the total population. San Francisco Region, 1890-1960

[19]). Several forms of time unit may be employed in the analysis of the process. Morrill chose to split the continuous wave into "exclusive but exhaustive periods of time" ([25], p. 7). Such an approach is usually imposed upon a researcher by the kind of data available. Nevertheless, since the wave can be depicted by a set of values characterizing the state of the system at given points in time, for theoretical discussion a continuous series of wave generations may be preferred to a discrete one.

(3) *The impact.* In the wave analogues of urban growth the prevailing representation of the wave source has been that of a stone (or several stones) thrown into water. This impact represents an addition of population to the system. This symbolization shows a direct influence of the language of inno-

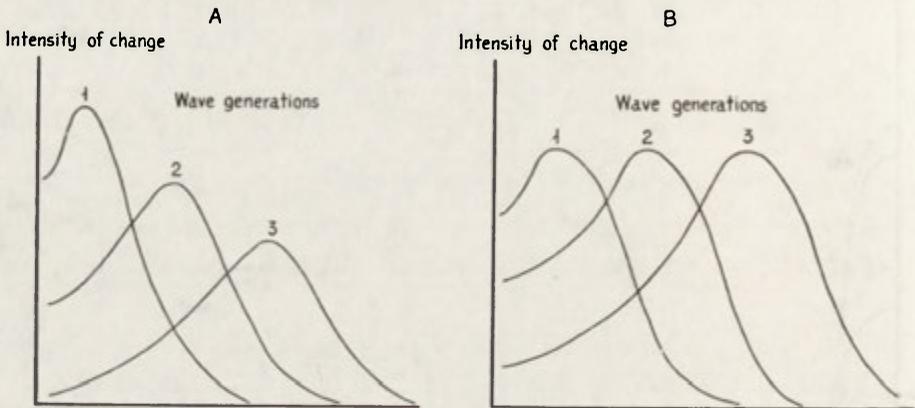


Fig. 4. The trends in wave amplitudes

vation diffusion. In contrast, however, to the first introduction of an innovation being a singular occurrence, the population increase in an urban area is a continuous process, and cannot be easily decomposed into a series of wave-generating events. The impact, therefore, should be imitated in the latter case in terms of a steady inflow to the system. A new wave is being produced when the amount of substance added reaches some critical value. The growing requirements for space tend to reduce the existing "storing capacity" within central areas, thus causing the impact to grow even for a constant population increase. A change in impact leads to an alteration of some or all of the basic wave parameters, following the general formula:  $c = fa$ ; where:  $c$  is velocity,  $f$  is frequency; and  $a$  is wavelength.

(4) *The role of friction.* In earlier studies this factor was dealt with basically in two ways. Firstly friction was considered an attribute of the process (Morrill [25]), with general dissipation of energy resulting in a diminishing strength of an innovation. Secondly friction was treated as an attribute of an area, and defined in terms of either a barrier (Yuill [33]) or a local resistance (Korcelli [19]). The chief difference between the concept of a barrier and that of a resistance lies in the latter's ability to assume both positive and negative values. It is possible to regard the system-based and area-based friction as concurring elements in the urban growth process. With the assumption of a continuous impact the limits of the process would be undefinable unless a factor like "economies of cohesion", representing the dissipation of energy,

is introduced. It may be made responsible for the spatial (and temporal) discontinuity of the urban growth waves. The influence of this factor, as well as the role of local resistance, may, of course, change over time.

(5) *Declining or constant amplitudes* (See Fig. 4). This is a rather perplexing question, closely related to the operation of the friction elements. In innovation diffusion theory the choice is unequivocal, and Morrill [25] transfers the first type (Fig. 4a) to his settlement diffusion model. But some empirical data tend to favour a second hypothesis (Fig. 4b), and for its further support a theoretical argument employing the urban density models may be called upon. While the declining amplitude view suggests a perpetuating of the existing disproportions, the urban density gradients tend, in fact, to be levelled-out. The proposed interpretation within the wave analogue framework runs as follows: In the more advanced stages of the growth process, the effect of friction is compensated for by the expanding potential and wave-generating ability of the system. This applies to a specific spatial dimension, and may not be relevant to settlement diffusion on the national scale. The constant amplitude (a stationary time series) hypothesis has been adopted in the present paper for the interpretation of the succession of urban growth cycles.

(6) *Growth cycles*. Most kinds of waves travel in groups, or trains, and there is every indication that urban growth waves follow this pattern. For the reasons that have been put forward above, the successive urban waves may differ in terms of their period, velocity, amplitude, and length, though their shape may be similar. An important assumption is that of uniform intra-cycle parameters if local resistance is held constant. It is further assumed that, within each cycle, transition in types of land occupancy or a specific density level is achieved. The relationship between the density and the rate of population increase is much more complex than that suggested by Pedersen [28]. The maximum rates of increase occur at several varied density levels; this is in accord with the growth cycles concept.

(7) *The composition of the growth process*. A single wave represents a product of several more or less independent processes superimposed one upon another, and its shape is a composite of the spatial effects of those processes. If the wave is interpreted in terms of changing relative population growth, then its basic components would include:

- (a) regular oscillations of the growth rate in an individual area, caused by its changing relative location within the system;
- (b) disproportions in the rate of change due to the principles of the human succession process;
- (c) disparities in the growth parameters between individual cycles;
- (d) variations in the regional rate of growth (fluctuations of the impact);
- (e) changes in the rate of increase owing to local resistance.

The time series analysis (see, for example: Harvey [15]; Granger [10]) provides the tools which make it possible to isolate the different components of the process. A comprehensive scheme would include the following general elements, whilst their urban growth counterparts are given in parentheses:

trend component	(c)
cyclical component	(a, b)
seasonal component	(d)
random residual	(e)

The trend component might also refer to changing amplitudes within one cycle. As to the inter-cycle differences it is conceivable to recognize the declining intensity of change during the more advanced stages of land occupancy.

## CONCLUSIONS

The paper deals with just one, though crucial, aspect of the urban growth process — population increase and redistribution. The wave analogue offers certain advantages in the analysis and representation of the process. However, other approaches may be equally fruitful.

Institute of Geography PAN, Warsaw

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## SEMI-URBANIZATION, WITH SPECIAL REFERENCE TO THE PROBLEM OF SETTLEMENT COMPLEXES

ANTONI ZAGOZDZON

The present paper is based on the results of research work carried out by the Department of Social Geography at Wrocław University under the direction of Professor Stefan Golachowski, whose works, together with those of Bohdan Jałowicki and of the present author, have been utilised here.

Among the various processes at present occurring in the socio-economic field, the phenomenon of semi-urbanization is worthy of attention. According to Golachowski this concept of semi-urbanization is to be understood as socio-economic and morphological changes in the countryside which do not always, or necessarily, lead to complete urbanization in the sense of a village either being annexed to an existing town or being transformed into a fully-developed town. A settlement form which is neither a town nor a traditional peasant village will occur as a result. It may be considered as a "semi-village-semi-town", i.e., something similar to the form called, in American English, a "rurban community".<sup>1</sup> It appears, however, that there may be circumstances when the processes do not lead to the development of a single, larger, fully urbanized settlement, but to the creation of groups of morphologically separate yet fully integrated settlements associated with each other by various kinds of relationships. Such groups of settlements — which may be called "systems" or "complexes" — are similar only in some respects to the traditionally-conceived town as a compactly built-up area. Some analogies between a settlement complex and a town are perhaps a little difficult to grasp in view of the lack of topographical links between the elements of the agglomeration settlements, which, in fact, are reminiscent of the "dispersed cities" known from the literature.

### THE PROBLEM OF URBANIZATION AND SEMI-URBANIZATION IN POLAND IN THE LIGHT OF SOME STATISTICAL INDICES

The non-conformity in ranking of a given voivodship may be a measure of semi-urbanization. For this purpose let us look at Table 1 showing the ranking of Polish voivodships with regard to the following values:

— process of urbanization (first column),

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<sup>1</sup> S. Golachowski, Urbanization of villages in the Opole voivodship, *Mat. Studia Międzyuczeln. Zakł. Podst. Probl. Archit. Urban. Budown.*, ser. IV, 5, 1966, p. 45.

— process of industrialization, by which we understand the percentage of the non-agricultural rural population (second column),  
 — the rate of private building activity in rural areas.

As seen in Table 1, there is only one example (Katowice voivodship) which occupies the same place in all three scales; the other voivodships all show smaller or greater divergences. The greatest divergences appear with regard to urbanization and industrialization (1 and 2) in Szczecin, Cracow, Rzeszów and Opole voivodships. Divergences in the ranking with regard to industrialization and building are seen in the highest degree in the voivodships of Wrocław, Białystok, Zielona Góra, Gdańsk and Rzeszów. In both eastern voivodships the building coefficients are higher than the industrialization coefficients, while the contrary is the case in the western voivodships.<sup>2</sup>

TABLE 1. Ranking of voivodships according to three coefficients

Voivodship	Ranking of urbanization	Ranking of industrialization	Difference 1-2	Ranking of building	Difference 2-3	Difference 1-3
	1	2		3		
Białystok	13	17	-4	5	12	8
Bydgoszcz	6	8	-2	4	4	2
Cracow	14.5	5	9.5	6	-1	8.5
Gdańsk	2	4	-2	12	-8	-10
Katowice	1	1	0	1	0	0
Kielce	14.5	15	-0.5	8.5	7	6
Koszalin	7	12.5	-5.5	14.5	-2	-7.5
Lublin	16	16	0	11	5	5
Łódź	11	9	2	3	6	8
Olsztyn	10	11	-1	13	-2	-3
Opole	8	2	6	7	-5	1
Poznań	9	7	2	10	-3	-1
Rzeszów	17	10	7	1	8	15
Szczecin	3	14	-11	17	-3	-14
Warsaw	12	12.5	-0.5	8.5	4	3.5
Wrocław	4	3	1	16	-13	-12.5
Zielona Góra	5	6	-1	14.5	-8.5	-9.5

The distribution of rural non-agricultural population in Poland is shown in Figure 1. The irregularity of this distribution is clearly connected with the two following maps (Figs. 2 and 3). Golachowski makes some interesting points about their background.<sup>3</sup> Figure 2 shows the percentage of the non-agricultural population in the total rural population in 1960. Figure 3 presents the same theme with reference, however, to a selected age group of the population (20-30 years) in 1960. It can also be treated as a forecast of what will happen as regards the rural population in general. With an evident tendency to an insufficient inflow of the younger age-groups into work in agriculture, larger and larger areas of Poland, now not only in the south-east, show, or will

<sup>2</sup> B. Jałowicki, Workers settlement as village urbanization factor, *Stud. Socjol.*, 1967, s, p. 195.

<sup>3</sup> S. Golachowski, Semi-urbanization?, *Pol. Persp.*, 10(1967), 4, p. 22.

show in the near future, a predominance of non-agricultural population. These facts lead to a peculiar obliteration of differences between town and country, both in the social and occupational spheres and in the technical-spatial sphere, which cannot be without influence on the future structure of settlement in Poland.



Fig. 1. Rural population gainfully-employed outside agriculture in 1960 (after S. Golachowski)

#### SOME ASPECTS OF SEMI-URBANIZATION IN OPOLE VOIVODSHIP

Opole voivodship belongs to those regions of the country which are distinguished by the greatest disproportion between the percentage of urban population and the percentage of the population dependent on non-agricultural jobs. This disproportion amounts to 27<sup>0</sup>/<sub>0</sub>, hence it seems appropriate to pay more attention to this region. We shall use a table (Table 2) presenting the differentiation in the respective districts (*poviats*) of this voivodship by analysing their ranking according to the three coefficients used at voivodship level in Table 1.

The greatest divergences in ranking in columns 1 and 2 are seen in the *poviats* of Opole and Racibórz and, in columns 2 and 3, in Olesno, Namysłów and Prudnik. The first two *poviats*, in spite of low coefficients of industrialization, show a great intensity of building; the last three show the reverse. Only Strzelce Opolskie *powiat* shows a regularity of rank in the three scales. It seems that the explanation of these facts is to be found in different geogra-



Fig. 2. Rural population gainfully-employed outside agriculture in 1960 (after S. Golachowski)



Fig. 3. Percentage of the non-agricultural population for the age group 20-30 years in the total rural population (after S. Golachowski)

phic-economic conditions and in the differences between the structure of population in the western and eastern districts of this voivodship, the eastern districts being characterized by autochthonous population, while immigrants from various regions of Poland have settled in the other districts.

The next map (Fig. 4) stresses the differing structure of the non-agricultural population in the two parts of the voivodship, by means of isolines drawn at 10% intervals, the first of which shows the area with 60% of non-agricultural population.<sup>4</sup> By ignoring the detailed distributions of the lower values, the map clearly shows the distinction between the two parts of the voivodship:

TABLE 2. Ranking of poviats in Opole voivodship according to three coefficients

District	Ranking of urbanization	Ranking of industrialization	Difference 1-2	Ranking of building	Difference 2-3	Difference 1-3
	1	2		3		
Brzeg	11	13	-2	9.5	3.5	1.5
Głubczyce	6	11	-5	9.5	1.5	-3.5
Grodzów	10	12	-2	14	-2	-2
Kluczbork	5	7	-2	7	0	-2
Koźle	1	1	0	5	-4	-4
Krapkowice	4	2	2	6	-4	-2
Namysłów	8	14	-6	8	6	0
Niemodlin	12	10	2	11	-1	1
Nysa	7	8	-1	12	-4	-5
Olesno	9	9	0	2	7	7
Opole	13.5	4	9.5	4	0	9.5
Prudnik	2	6	-4	12	-6	-10
Strzelce	3	3	0	3	0	0
Racibórz	13.5	5	8.5	1	-4	12.5

(a) The eastern part, which is situated between the River Odra and the Upper Silesian Industrial Region; this is the area in which the problems mentioned show features of continuity.

(b) The western zone, where localities with a higher percentage of non-agricultural population appear sporadically. It is, a matter of fact, an area with a predominance of agricultural characteristics.

The first zone — the highly urbanized border of the Upper Silesian Region — is industrialized to a high degree. The distribution of industrial plants, mainly medium and small, does not show much concentration. They are situated in a large number of settlements, not all of which are urban in character. One result of this specific distributional pattern is to reduce daily journeys to work. Commuting distances are among the shortest in Poland.<sup>5</sup> This region, consisting chiefly of Opole, Krapkowice, Strzelce Opolskie, Koźle and Racibórz

<sup>4</sup> The map included in S. Gołachowski's above-mentioned work was derived from the National Census of 1960.

<sup>5</sup> In his study on the structure of the daily journey to work in Poland T. Lijewski draws attention to this problem.

poviats, and covering scarcely 40% of the area of the voivodship, concentrates half of the voivodship's population.<sup>6</sup>

The structure of the settlement network is essentially different in these two areas. A settlement network based mainly on service centres for the agricultural hinterland appears almost everywhere in the west;<sup>7</sup> on the other

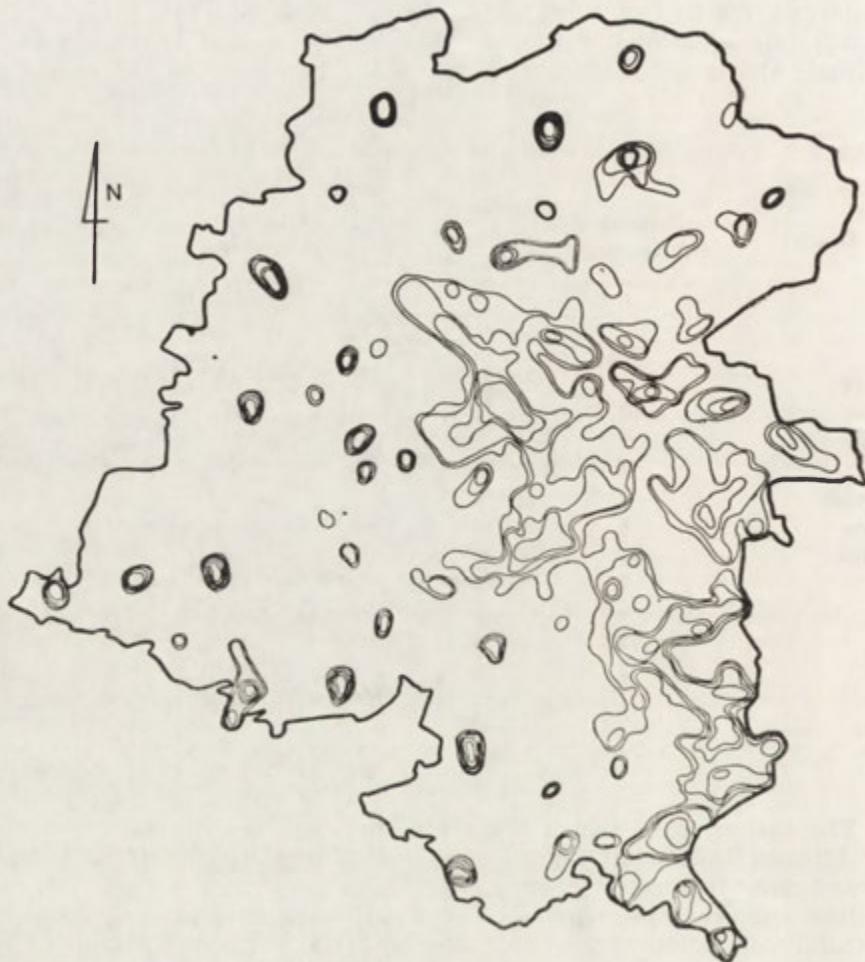


Fig. 4. Percentage of the non-agricultural population in Opole voivodship (after S. Golachowski)

The first external isoline shows the area with 60% of non-agricultural population; the other isolines are shown at 10% intervals.

<sup>6</sup> In spite of the fact that there is a rather large forest area in this region (13% of total area), which reduces the values.

<sup>7</sup> C. Kania presents the problem of service centres which are formed in an essentially different way in the mentioned sub-regions of the Opole voivodship. See C. Kania, Centres of social-economic links in settlements of the Opole voivodship and the problem of urbanization, *Mat. Studia Międzyuczeln. Zakł. Podst. Probl. Archit. Urban. Budown.*, ser. IV, 5, 1966, p. 129.

hand, the settlement network of the eastern districts has to a high degree the characteristics of an urbanized network. A great diversity of settlement types and forms appears here, as well as the formation of strongly-integrated groups of settlements, which may be called settlement systems or complexes.

#### THE SETTLEMENT COMPLEX AS AN ASPECT OF SETTLEMENT INTEGRATION WITHIN PARTLY-URBANIZED AREAS

The progress of rural urbanization brings about the creation of new settlement forms which do not fall within the traditional categories of village and town.

The local settlement complex is to be understood as an agglomeration of urban and rural settlements executing as a whole some higher and therefore exogenetic functions.<sup>8</sup> These settlements are linked functionally with each other by strong relations (endogenetic functions), and sometimes they are also united topographically. The existence of the respective settlement, as an element of the complex, is indispensable for the correct functioning of the whole.<sup>9</sup> The interrelationships of settlements in the complex are, therefore, twofold; firstly, those resulting from the higher function and secondly those meeting the needs of inhabitants within the complex. This definition is rather wide and includes urban agglomerations of various type, size and functions. However, in this paper it relates to small settlement complexes performing, in principle, the lower-rank functions. Such complexes are typical for partly-urbanized areas.

According to the definition mentioned above, a complex is to be understood as a group of settlements which in sum meets a certain quantum of human needs with regard to work, housing and services. The definition contains also a statement that none of these settlements must by itself fully meet these three kinds of needs. Thus, among the settlements there are ascertainable relationships, the number of which depends on the number and the kinds of elements. The problem, therefore, is reduced to the study of the number of relationships, of their force, and of the character of the structure of the complex.

If one considers two elements, housing and work, then the daily journey to work will be the factor linking the settlements together, and the number of persons travelling to work from the given settlement in relation to the number of the active population inhabiting the settlement will be the measure of the link. With the help of this coefficient one can define the degree of integration of the complex.

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<sup>8</sup> See K. Dziewoński, *Baza ekonomiczna i struktura funkcjonalna miast. Studium rozwoju pojęć, metod i ich zastosowań* (Sum.: Urban economic base and functional structure of cities. A study of the development of concepts, methods and applications), *Prace Geogr. IG PAN*, 63, Warszawa 1967, where the author develops in detail the problem of both kinds of functions with regard to towns. It appears that in towns as also in settlement complexes these functions play a basic role in integrating the system.

<sup>9</sup> The author has described this problem in some of his works, especially in: Settlement complexes with non-agricultural functions as a form of urbanization of the country (in the already mentioned *Mat. Studia Międzyuczeln. Zakł. Podst. Probl. Archit. Urban. Budown.*) and: Problem of local settlement complex, *Geogr. Pol.*, 14, Warszawa 1968, p. 346.

In the course of studies carried out in the Opole region the following method of using data was selected for indicating the degree of settlement integration.

Coefficients between 3.5 and 10 indicate that the settlement is in the preliminary phase of joining the complex, or that it is situated on the periphery of the complex. It therefore plays the role of a dormitory satellite for more than one centre.

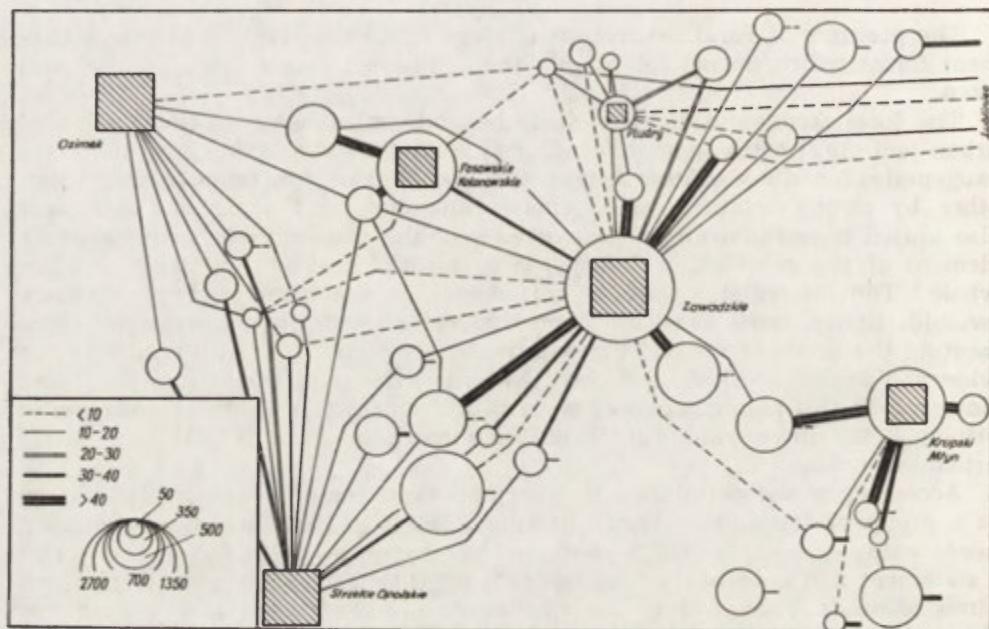


Fig. 5. Simplified scheme of the settlement network in a part of Opole voivodship Production — Settlement Complexes. Degree of linkage = the rate of persons working outside their place of residence to the number of economically-active population. Squares — main places of work. Circles are proportional to the number of economically-active inhabitants.

Coefficients between 10 and 20 show that the competition between the centres and the relations between the respective localities and the various centres may be almost regular; as with the previously-mentioned type, the settlement may be a satellite of more than one centre. Coefficients between 20 and 30 can be considered as typical values for the outer part of a fully-formed complex, although competition by other centres is sometimes possible.

Coefficients between 30 and 40 indicate high integration of settlements without competition on the part of other centres. Coefficients over 40 appear when a settlement is functionally fully integrated with the centre. It is then at least a few times stronger than the sum of the remaining relationships.

Figure 5 explains this problem. It contains a simplified scheme of the settlement network composed of local settlement complexes in one of the regions of Opole voivodship. Their origin can be traced back to the beginnings of the 19th century and is connected with iron foundries based on water power from small streams (in this case the river Mala Panew) and on local bog iron ore, with wood obtained from the neighbouring forest areas as fuel. The current modernization of these plants has involved the persistence of the exogenetic

functions, the growth of their importance and, in consequence, the growth of agglomerations. What happens to the centre or centres of the complexes? In the example shown there are three single-centred complexes of varying size. In this case the centre of the complex concentrates the exogenetic industrial functions which give rise to the complex.

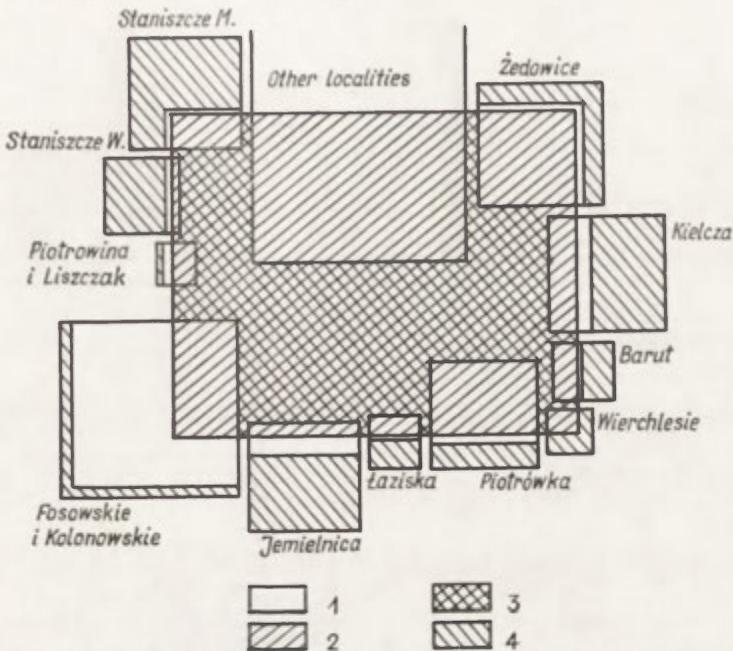


Fig. 6. Diagram of the structure of a settlement complex. Structure of the Zawadzkie settlement complex. Degree of linkage with the complex-generating functions as expressed by the number of commuters

1 — persons employed in their place of residence, 2 — persons employed in Zawadzkie, 3 — local employees working in Zawadzkie, 4 — persons employed outside the complex

The connection of settlements of the complex with the establishments fulfilling a higher function is simple and can be expressed by the percentages of a particular settlement's share in this function, according to the formula:

$$F = \frac{a}{n} + \frac{b}{n} + \frac{c}{n} + \dots \text{ where:}$$

$n$  is the general number of people employed in establishments of a higher function,

$a, b, c, \dots$  number of people from the respective settlements linked with the establishments with the exogenetic function. This kind of situation can be expressed in the form of a diagram (Fig. 6) representing the structure of the complex. The example quoted above refers to the Zawadzkie complex from the central part of Fig. 5. It appears that by means of a diagram one can not only present the structure of a particular complex in various stages of development, but also effect comparative analyses of various complexes. Figure 7 is an attempt to present examples of complexes that differ with regard to size, kind of higher function, degree of integration and phase of development.

Brief attention must also be paid to another type of relationship, that between residence and services, a very important factor of structuralization

of the complex. One can presume that the degree of importance of this kind of relationship is proportionate to the percentage of the active non-agricultural population. For each of the settlements examined we calculate the coefficients of the equipment in services ( $W$ ), of the fulfilling of needs ( $WP$ ) and then the coefficient of attraction of the respective localities of the complex ( $WA$ ).<sup>10</sup>

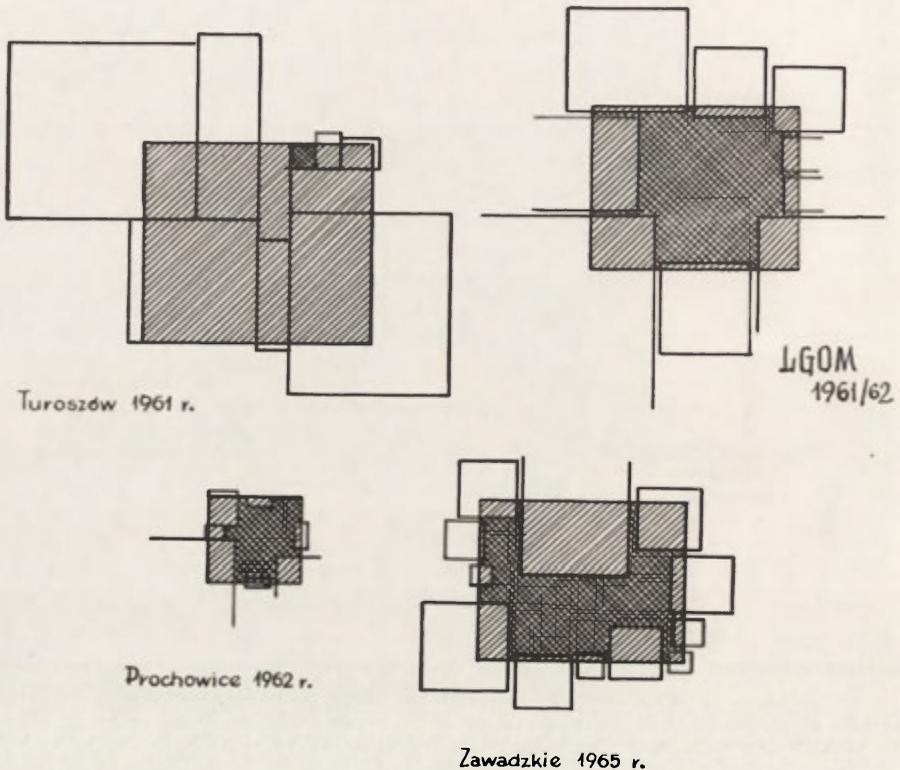


Fig. 7. Various kinds of settlement complex

Links between settlements and the superior functions as expressed by the number of commuters (selected examples)

The complexes examined by the author do not always show a constant proportion of production and service functions. Numerous examples are known where in a complex with considerably developed industrial functions a distinct shortage of services is to be observed. It is, however, frequently related to the development stage of the complex itself. In spite of this point, the scope of services, even in case of complexes strongly specialized in industry, seems to be an essential matter. However, when speaking about the complex as a strongly integrated group of settlements in which a certain quantum of the needs of the inhabitants has been combined together, then any shortage of establishments counted to the endogenetic group may lead to the weakening of the complex.

<sup>10</sup> The coefficients have been taken, according to B. Jałowiecki, from the work: C. Carnau, P. Rendu, *Où les habitants de la banlieue parisienne font-ils leurs achats anormaux?*, in *L'attraction de Paris sur sa banlieue*, Paris 1965, p. 201.

The organs of planning and administration seem to be aware of the important problem of the necessity of localizing a larger number of service units (than would result from the respective norms defining the proportion of such units in relation to the number of the inhabitants) in those settlements that are centres of the complex.

Research work carried out in some regions of the country on the problems of settlement complexes has allowed the formulation of certain hypotheses about the development of these forms. Research workers have tried to present these hypotheses by means of a schematic diagram (Fig. 8) showing the growth of the settlement network and of urbanization according to the stages of development of the settlement complex. In the development of the new production and settlement complex of the Lower Silesian Copper Basin, however,

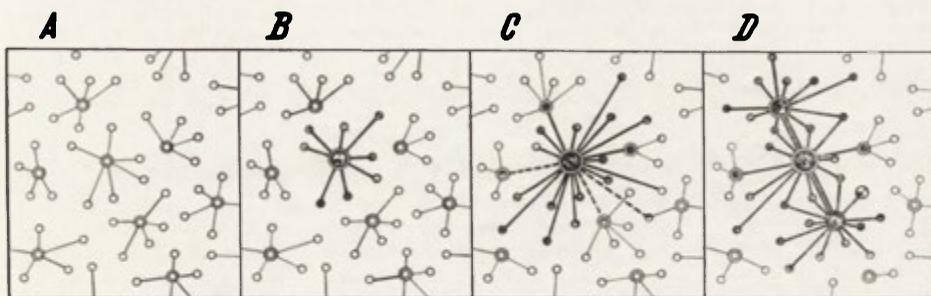


Fig. 8. The formation of a settlement complex

- A — Phase preceding investment. Traditional network based on the system of service centres and rural settlements
- B — Preliminary phase — development of exogenous functions. Shaping of a new agglomeration of a local character
- C — The lengthening of daily commuting routes and the growth of a centre as a further stage in the development of the complex
- D — Formation of a polycentric system. Diversity and plurality of relationships. Consolidation of the complex

some general principles seem to be of a wider importance. Namely: in our regions the processes of semi-urbanization by the creation of settlement complexes are usually realized not by building new settlements but by the reorganization of the existing settlement network. Then the older network frequently resembles, in some respects, traditional models based on a system of central places. The change of rank of these centres and their specialization with regard to the new kind of functions accompany the re-organization. A system of new inter-settlement relationships is formed, those relating to production consisting of the collaboration of industrial plants and of journey-to-work movements between place of residence and place of work.

Changes in the morphological structure of the respective settlements and of the whole complex are a process which appears somewhat belatedly in the settlement transformation. One of the tendencies of this transformation is the tendency of the system to create topographical links between the elements. However, it is not a common fact but it is to be observed in many complexes. The topographic integration of the complex elements can be made by the localization of new building between older settlements. These take the form of typical commuter settlement units extending along roads. Figures 9 and 10 illustrate

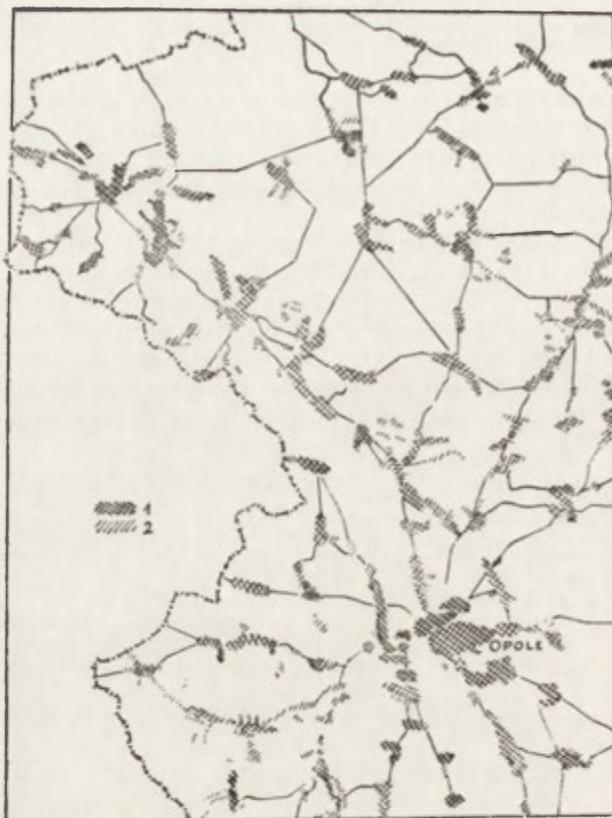


Fig. 9. Ribbon development in the vicinity of Opole  
1 — old, 2 — new

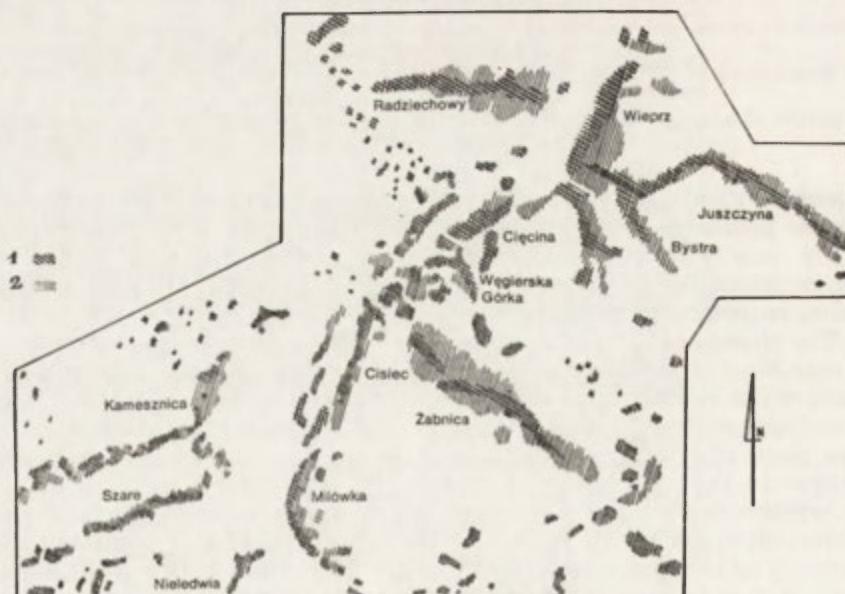


Fig. 10. Built-up area. Development of workers' settlements in a rural area, as illustrated by the Węgierska Górka region  
1 — older buildings, 2 — new buildings (1953-1966)

this problem, presenting the process of ribbon development in two regions differing in their geographic environment: the region of Opole and that of the Zywiec valley. The process of filling in the free spaces between the settlements, as elements of the complex, seems to bring to a close a certain development cycle of the complex by means of spatial consolidation. This short review of the broad problems of settlement complexes leading to partial urbanization of a settlement network does not exhaust the whole matter. This is still a topic of great interest for many geographers, including the author.

Finally attention must be drawn to the fact that such a settlement form and such a conception of the settlement network reorganization seems to be advantageous to the conditions of a socialist state. A complex is clearly a means of obliterating some essential differences between town and country. It may also create much more favourable conditions of living, considering that it consists of groups of small or medium-size settlements in a good situation as far as the geographic environment is concerned. The inhabitants of such a complex may every day avail themselves of the benefits of rural life at the same time as they have access to all the services that are usually provided by a town. In a complex, as in an integrated group of settlements, there are much greater chances than in a single settlement of satisfying the widening and more and more differentiated social needs. It is of great importance that the development of such organisms, often started by way of evolutionary processes, should be effected in a planned way, so that the most appropriate trends of development may be achieved.

Wrocław University



## CHANGES IN THE CHARACTER OF MIGRATION MOVEMENTS FROM RURAL TO URBAN AREAS IN POLAND

ELŻBIETA IWANICKA-LYRA

The intensity of the influx of the rural population to urban centres has always been influenced by general migration movements, which have involved, amongst other features, an accelerated penetration of information and an increased responsiveness of people to the resulting stimuli. In Poland, migration on a mass scale occurred during and after the two World Wars.

Between 1914 and 1917 migration movements were connected with the evacuation of civilians by the Russian authorities and with the mobilization of the male population. After the war there occurred considerable repatriation of both Polish and German population groups as a result of boundary shifts. During the Second World War the intensity of migration movements was much higher; together with the migration resulting directly from the war they involved about 22 million people.<sup>1</sup> These migration movements comprised the deportation of a part of the Polish population to Germany, resettlement of the population of whole villages within the boundaries of what the Germans called General-Gouvernement, deportations to concentration camps or to compulsory work in Germany, the evacuation of the population of Warsaw after the 1944 Warsaw Uprising and from certain areas after bombardment, and the immigration of rural population to the voivodships of Lublin, Cracow and Rzeszów from the south-eastern areas, harassed by nationalist bands of Ukrainians. As a result of the war there occurred compensatory movements of population, i.e. the repatriation of Poles who had been deported from their original place of residence by the Germans and resettlement of Poles due to the shift of Poland's borders.<sup>2</sup>

The migration of the rural population to the cities constitutes an integral part of these general migration movements. The direct motivations of these movements are to be seen in the ease of settling in urban centres and of re-populating the cities left by the Germans. These two motivations were much stronger after the Second World Wars than they were after the First. This was because of the higher losses in urban population and also the Government's action of re-populating the old Polish territories regained from Germany as

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<sup>1</sup> K. Dziewoński and L. Kosiński, *Rozwój i rozmieszczenie ludności Polski w XX wieku* (The growth and distribution of Poland's population in the 20th century), PWN, Warszawa, 1967, p. 161.

<sup>2</sup> L. Kosiński, *Wędrówki ludności w Polsce* (Population migration in Poland), *Geogr. w Szk.*, 19 (1966), 2, pp. 53-62.

a result of the Second World War. In the more recent period, as a result of the country's industrialization, migration was caused by economic incentives, i.e. by the possibility of better-paid jobs in the rapidly developing industrial districts.

The extent of emigration from rural to urban areas during the period in question is presented in Table 1. Both the absolute (column 4) and relative (column 6) figures show that migration from rural to urban areas during the 14 years after the Second World War was more intense than during the 16-year period between the two wars. Moreover, such measures as the mean annual emigration from villages to cities (column 5) or the intensity of annual emigration<sup>3</sup> in the years following the Second World War are twice as large as those for the period 1922-1938.

TABLE 1. Emigration of rural population to urban areas

Years	Mean	Natural	Net emigration from		Net emigration	
	number	increase	rural to urban areas		(%)	
	of rural population	million persons	total	mean annual	total rural population	natural increase
1	2	3	4	5	6 (5:2)	7 (4:3)
1922-31	21.8	4.0	1.1	0.11	0.5	27
1932-38	24.1	2.4	0.5	0.07	0.3	21
1946-50	16.1	1.3	1.2	0.24	1.5	95
1951-60	15.7	2.9	1.3	0.13	0.8	46

As to the values of the net migration from rural to urban areas (column 6), it is seen that after a period of intense migration movements of the rural population after the First World War there occurred an abrupt slowing down of the efflux. This was caused by the economic depression of the 1930's.

In spite of the heavy damage to the cities during the Second World War, there took place an increase in the number of emigrants from the rural areas to the cities. The decrease of the migration of the rural population to cities during the statistical period 1950-1960 was connected with the completion of the settlement of the Western and Northern Territories. Since 1960, the migration of the rural population to urban areas has been steadily diminishing as regards both absolute figures and rate per 1000 of population. In 1967, migration to urban areas comprised a total of 244,000 village inhabitants,<sup>4</sup> whereas the urban population grew by 135,000 persons<sup>5</sup> (the difference results from the simultaneous out-migration of some urban population to rural areas). This growth of the urban population is relatively higher than that after 1952, which is connected with a smaller migration of the urban population to rural areas rather than with the larger absolute number of migrants to urban areas.

<sup>3</sup> Defined as the ratio of net emigration to natural increase.

<sup>4</sup> *Ruch wędrówkowy ludności w Polsce w latach 1960-1967* (Migratory movements of Poland's population in 1960 to 1967), Stud. Prace Statyst., 18, Warszawa, 1969, GUS, pp. 17-18, Tables 6-7.

<sup>5</sup> *Rocznik Statystyczny 1969* (Statistical Yearbook 1969), Warszawa, 1969, GUS, p. 66, Table 43.

An analysis of the migration of the rural population to urban centres discloses the significance of the movement in the process of urbanization. During the years 1922–1938 the immigration from rural areas amounted to about 130% of the urban natural increase, the percentage of urban population being relatively low. In 1946–1950, this index increased to 170%. During these periods, migration from rural areas to urban centres constituted the decisive factor in the increase of the urban population. An analogous index calculated for the years 1950–1960 implies a smaller share of the rural migrants in the process of urbanization: migrants to cities constituted only 60% of urban growth.<sup>6</sup> This index is, however, hardly comparable to the indices calculated for the earlier periods, for between 1950 and 1960 certain events contributed to a considerable increase of the urban population. This phenomenon was connected with the inclusion of parts of adjacent rural areas in the administrative boundaries of towns, as well as with the raising of a number of urban settlements to the status of towns. At the same time, there was a growth in the natural increase of the urban population whereas in 1931–1932 it was 8%, in 1960 it was 1.3%. This was partly a result of rural immigration to urban areas.

Thus, migration from rural to urban areas was one of the main factors of urbanization, and in 1950–1960 migration produced an increase in the urban population of about 19%.<sup>7</sup> In view of the significance of migration, it seems desirable to study its characteristic features and mechanisms.

Apart from the common features of all migration movements, observable also in other countries, the migration movements from rural to urban areas in Poland show two specific features:

- (1) a higher intensity of migration when compared with other countries at a similar stage of socio-economic development,
- (2) the dependence of migration not only on the labour market but also on planned centres of growth.

Investigation of the changes in the character of migration from rural to urban areas can be made only with the aid of adequate statistical data. Since the accuracy and reliability of these data are a condition of correct conclusions, a few remarks are necessary.

#### STATISTICAL DATA

In Poland there are several sources from which the fundamental data concerning migration can be drawn. They are the following:

(1) General population censuses containing both direct and indirect data. Among the latter there are data concerning the population number in two successive censuses and data pertaining to the vital statistics of the population. Direct information is obtained from the answer to the question about the inhabitant's place of birth or his place of residence at a specific time. This question was included in the census of 1950 and the resulting information permitted the drawing-up of a picture of population migration in the years 1939–1950. More extensive data were collected in the census of 1960, for, apart

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<sup>6</sup> M. Pohoski, *Migracje ze wsi do miast* (Sum.: Migrations from rural to urban areas), PWE, Warszawa, 1963, pp. 56–57.

<sup>7</sup> K. Dziewoński, Urbanization in contemporary Poland, *Geogr. Pol.*, 3, Warszawa, 1964, p. 38.

from information about the place of residence in 1950, the collected data also covered age, sex, education, occupation and place of work of the migrants. These data were published for individual voivodships.

(2) The files of the Registration Offices. Since 1952 the form of the documents of the Registration Offices has remained unchanged, thus allowing full comparability over time. These data are also published by the Central Statistical Office for the voivodships and refer to the number and direction of migration moves from rural to urban areas, as well as the age and sex of the migrants.

(3) The files of the personnel departments of employers. These are very detailed data, but they are not always comparable and they are marked by different levels of reliability.

(4) Polls organized by research institutes in various localities. Such material is made available in scholarly publications.

Because of the lack of accurate statistical data on migration from rural to urban areas during the inter-war period, the ensuing considerations are limited to the analysis of the phenomena after the Second World War. Following the main source of information, i.e. the population censuses, this period is divided into three phases:

— the first period, extending up to 1950, is one of intense population migration lasting mainly until 1947 and coinciding with a period of reconstruction of the country and the formation of a centrally-planned economy.

— the second phase covers the years 1950–1960 and is marked by a natural increase, a higher stability of the population as regards place of residence, and regional, multi-phase migration from rural to urban areas.

— the third phase extending from 1960 up to the present is characterized by further processes of industrialization and urbanization, accompanied by declining natural increase. The rural-urban migration takes mostly the form of multi-stage moves within particular regions.

#### CHANGES IN THE CHARACTER OF MIGRATION FROM RURAL TO URBAN AREAS AFTER THE SECOND WORLD WAR

Migration in the period examined underwent changes not only with respect to the intensity of the migration movements of the rural population, but also as regards *the direction of migration*. Thus, in the first phase of migration, the predominant trend of movement was to the Northern and Western Territories. In consequence of war hostilities, the towns of these areas were, on average, destroyed to the extent of 54%, and the losses in the housing resources in the cities of Wrocław, Szczecin, Gdańsk, and Opole, and especially in small towns, sometimes exceeded 90%. Characteristically, although the first wave of settlers went to towns that were relatively less devastated, the destroyed towns were ultimately re-populated and re-developed, for they already had basic functions. Migration was connected with the possibilities of finding employment, at first in the reconstruction of factories and afterwards in manufacturing itself. This circumstance later had an adverse effect on the development of the smaller towns, which were slower in recovering from war damage and unable to regain their functions as centres of commerce and handicrafts, now superseded by cheaper industrial

products. This "crisis of the small towns" affected the settlement movements in the Western Territories as well as those in the rest of the country.<sup>8</sup>

The settling of the Polish Western and Northern Territories was supervised by the Ministry of the Regained Territories, founded in 1945, in co-operation with the Bureau of Settlement and Resettlement Studies, and with the Scientific Council of the Problems of the Regained Territories.<sup>9</sup> As a result of the activities of the Council, a settlement plan was outlined. It postulated a latitudinal resettling of repatriates, i.e., directing immigrants from Lithuania to the northern voivodships (those of Gdańsk and Szczecin), those from the Ukraine to the south-western voivodships (Opole and Wrocław), and those from Byelorussia to the voivodship of Zielona Góra. This conception of re-settlement was intended to secure for the settlers similar conditions of geographical environment and to prevent the disruption of existing socio-cultural ties. The later movements of repatriates within the Regained Territories were spontaneous and could not be controlled by the institutions responsible for the initial re-settlement process. For this reason, these movements could not be traced by the statistical offices. In any case, these migration movements produced a considerable intermixture of these various population groups in the towns of the Regained Territories. In time, however, these various groups developed into integrated communities.

In consequence of the repatriation from the Soviet Union between 1944 and 1949 about 1500 thousand people came to the present territory of Poland. Of these, 1240 thousand settled in the Western and Northern Territories, mainly in the towns, because of better possibilities of finding jobs and also in expectation of improving their living conditions.<sup>10</sup>

The group of Polish re-migrants from Western Europe, who settled relatively early on the Regained Territories, was much smaller. Altogether, about 110 thousand people were registered as re-migrants, most of them coming from France and Germany. They settled in groups in selected towns in Upper and Lower Silesia.

But the most numerous group among the settlers in the towns of the Northern and Western Territories were immigrants from those parts of pre-war Poland that still remained within the revised national boundaries. The resettlement movement from Central Poland comprised altogether 2200 thousand people, that is 12% of the total population of pre-war Poland. The migration movement affected mainly the neighbouring voivodships; for instance, people from the voivodship of Poznań went chiefly to that of Zielona Góra, while inhabitants of the voivodship of Kielce settled in Lower Silesia. Simultaneously, apart from these short-distance movements, there was also migration from more distant areas, such as the voivodships of Białystok, Lublin, Rzeszów or the overpopulated voivodship of Cracow. The migrants from these districts moved to the big cities, especially the urban centres of Upper Silesia and Wrocław.

Organized mass migration to the Western and Northern Territories ceased

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<sup>8</sup> S. Nowakowski, *Miasta Ziem Zachodnich (The towns of the Western and Northern Territories)*, in: *Socjologiczne problemy miasta polskiego*, PWN, Warszawa, 1964, p. 133.

<sup>9</sup> L. Kosiński, *Procesy ludnościowe na Ziemiach Odzyskanych w latach 1945–1960* Sum.: Demographic changes in the Recovered Territories, 1945–1960), *Prace Geogr. IG PAN*, 40, Warszawa, 1963, pp. 52–53.

<sup>10</sup> *Ibid.*, p. 48.

in 1947, that is after the existing housing resources had been exhausted, and thereafter further settlement could be achieved only by building new residential units or by major repairs to existing buildings. One consequence of these migration movements was that in 1947, for instance, 41<sup>0</sup>/<sub>0</sub> of the inhabitants of Wrocław were immigrants who had come directly from rural areas.<sup>11</sup> In the case of smaller urban settlements, e.g., Kędzierzyn, about 90<sup>0</sup>/<sub>0</sub> of the population was of rural origin.<sup>12</sup>

The first phase of the migration movements in the areas that had formed part of pre-war Poland was also marked by migration from rural to urban areas. This influx contributed to the growth of large cities, which offered opportunities in construction jobs, even for unqualified manpower. In this period there were several centres of migration from rural to urban areas, especially Warsaw, and the cities of Poznań, Cracow, and Łódź. Whereas Warsaw and Cracow (after construction of Nowa Huta had begun) were destinations of rural migrants from the whole country, the other cities attracted migrants mainly from the neighbouring voivodships. During that period migration took place mainly to big and medium-sized urban centres; migration to small towns was rather scanty. This is attributable to the fact that the reconstruction of the larger urban settlements promised a substantial improvement of living standards, owing both to the provision of modern facilities and to a broad network of services, and to the fact that such movements were organized by the industrial establishments themselves.

A characteristic feature of the second phase of the migration movements (1950-1960) was the appearance of regional centres of migration. This was connected with short-distance migration and with a tendency for migrants to settle in the capital cities of their native voivodships. A closer examination of this feature revealed, however, that it was not fully in agreement with Ravenstein's law: for the intensity of migration between different places depends not only on the physical distance between them but also on the level of industrialization of the whole voivodship,<sup>13</sup> on the density of its urban network and on the existence of large cities in it.<sup>14</sup> In the voivodships of Łódź, Warsaw and Bydgoszcz more than 50<sup>0</sup>/<sub>0</sub> of the migrants remained within the boundaries of their respective voivodships. The twice-smaller share of urban population in the voivodships of Rzeszów, Kielce, Lublin and Białystok resulted in the percentage of emigrants to the regional centres of absorption being smaller: 36, 31, 35 and 38 respectively.

A supra-regional significance is to be ascribed to the cities of the Cracow voivodship (Cracow, Nowa Huta) and to a number of industrial urban centres in the Regained Territories; these latter attracted immigrants mostly from the neighbouring voivodships, but not infrequently they were also the destination of migrants from distant voivodships as in the case of migration from the voivodship of Lublin to that of Wrocław.

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<sup>11</sup> I. Turnau, *Studia nad strukturą ludnościową polskiego Wrocławia* (Studies on the population structure of Polish Wrocław), *Studia i Mat. Inst. Zach.*, Poznań, 1960.

<sup>12</sup> S. Nowakowski, op. cit., p. 149.

<sup>13</sup> M. Pohoski, op. cit., pp. 58-60.

<sup>14</sup> W. Borejko, *Migracje ludności w województwie zielonogórskim w latach 1953-1962* (Population migration in the voivodship of Zielona Góra, 1953-1962), *Lubuskie Tow. Nauk.*, Zielona Góra, 1968, p. 150.

In the period under examination, 40-70% of migrants lived outside the boundaries of their "voivodship of origin".<sup>15</sup> An analysis of the directions of migration of this group shows that there were centres of absorption on a national scale. These consisted chiefly of towns in the voivodship of Wrocław (immigrants from the voivodships of Poznań and Lublin), and the voivodships of Warsaw (from the whole country), Katowice (from southern Poland) and Gdańsk (from the northern and central voivodships).

Studies of micro-regions have revealed another feature typical of the second wave of migration movements, namely the "multi-stage" character of the migration process. Settlers from rural areas used to go first to small towns performing mixed functions, where they could more easily find employment as unqualified workers. After having obtained rudimentary training for their jobs or having completed vocational evening courses, they went to the bigger, more industrialized towns or cities which had a higher demand for qualified manpower. This "multi-stage" character of migration did not completely eliminate migration directly from rural to urban areas, but the latter did not significantly affect the proportions of the respective absolute figures at that time.

A model illustration of multi-stage migration is the influx of population to the town of Tarnobrzeg, where 80% of the inhabitants came from rural areas. Closer investigations have shown that their road to Tarnobrzeg ran through other, predominantly old-established centres of manufacturing with similar production characteristics.<sup>16</sup>

An additional factor contributing to this multi-stage migration was the administrative restriction on settlement in the large cities, introduced in 1954. These restrictions contributed to the spontaneous growth of suburban settlements which, owing to transport facilities, became the place of residence of people employed in the core of the agglomerations. These forms of settlement were marked by a high percentage of commuters. Originally these settlements were small places with populations of 1000 to 20,000; but owing to migration they developed rapidly. An analysis of the totals and balances of migration movements in 1960, of the directions and places of origin of migration, and of the commuters of 154 towns and settlements within the boundaries of 8 large urban agglomerations proved that 115 were settlements which had developed in consequence of intensive immigration. These settlements thus manifest a later stage in the process of migration to large cities.<sup>17</sup>

The third phase of the migration movements in Poland, which has existed

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<sup>15</sup> J. Herma, Napływ ludności do miast regionu siarkowego jako współczynnik procesów urbanizacji przemysłu siarkowego (The influx of population into the towns of the sulphur-mining district as a coefficient of urbanization processes), *Zesz. Bad. Rejon. Uprzem.*, 29, 1968, pp. 139-176; L. Straszewicz, Wędrowniki ludności jako podstawa rozwoju miast przemysłowych na przykładzie aglomeracji łódzkiej (Rés.: Migrations de la population comme base du développement des villes industrielles sur l'exemple de l'agglomération de Łódź), *Czas. Geogr.*, 34 (1963), pp. 361-374.

<sup>16</sup> J. Herma, op. cit., p. 153.

<sup>17</sup> E. Iwanicka-Lyra, Typy miast i osiedli tworzących aglomeracje wielkomiejskie (Sum.: Types of administrative units forming large urban agglomerations, and the migrational movements), *Przeegl. Geogr.*, 42 (1970), pp. 359-366.

since 1960, began during the second phase. Short-distance migration continues to predominate and this conditions multi-stage migration. Also, the earlier-established division into national, regional and local centres of absorption exists to this day. The emergence of new industrial centres, such as Płock, Tarnobrzeg, or Puławy, generates a temporary intensification of migration in different regions. In the third phase of migration, the voivodship of Katowice, Warsaw, Warsaw-city and the voivodship of Wrocław retain their attractive power for immigrants. The highest indices of emigration are observed in the voivodship of Rzeszów, Lublin, and Kielce.

The changes in the dynamics and directions of migration have been accompanied by changes in the demographic characteristics of the migrants. In the first phase, the *age structure of the migrants* exhibited a predominance of persons in the productive age-group. In the 1950's this structure shifted towards the younger age-groups: most emigrants left their villages before the age of 22-24.<sup>18</sup> This tendency survives in the third phase, which is connected with the entry into the productive age-group of the young people belonging to the post-war population explosion.

The selection of migrants according to age is a common fact observed in other countries also. It is due to the easier adjustment of young people to new conditions of urban life, as well as to weak family ties and emotional bonds and lower financial status. In Poland the selection of migrants by age has also resulted from the higher natural increase of the rural population, from the mechanization of agriculture and from the resulting decrease in the demand for manpower in the rural areas (and the limited opportunities of employment in non-agricultural occupations in the villages). In addition the availability of a broad network of educational institutions of secondary and higher levels in the towns has undoubtedly stimulated the emigration of young people. The possibility of obtaining vocational training or higher education was traditionally identified by the rural population with social advance. In later years the motivations for migrating were reinforced by the financial aspect: on 5 July, 1963, a bill was passed preventing the partition of farms. This bill, based on the recommendations of the Polish United Workers' Party, was intended to prevent the partition of farms through inheritance. It imposes the rule of passing the whole farm on to one of the children, with the obligation of that child to pay off all those of his brothers or sisters who earn their living by work on the farm. Apart from preserving the existing structure of farm size, the bill also aimed at preventing the outflow of capital from the rural areas and at the encouragement of superfluous manpower to move to urban centres.

On the basis of the age structure of migrants in recent years we may draw the conclusion that the new law has achieved its aims with regard to the gaining of additional manpower for industry. But sociologists still discuss the question whether the outflow of the most valuable manpower to the cities will not result in the maintenance of the traditional model of agriculture and thus retard the intensification of agricultural production. This is a statement based on intuition not yet justified by empirical results.<sup>19</sup>

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<sup>18</sup> M. Pohoski, op. cit., p. 71.

<sup>19</sup> R. Turski, *Przemysł a przemiany wsi* (Industry and the changes in the rural areas), in: *Przemysł a społeczeństwo w Polsce Ludowej*, Ossolineum, Wrocław, 1969, p. 349.

In recent years, there has occurred an imbalance in the age structure of the rural population, resulting from an increase of population in the pre- and post-productive age-groups and a decrease of the wage-earning population. This causes financial strain on the working population of the villages, mitigated, however, by relatively low costs of living in rural areas and by the support of the State regarding the education of children.

The *sex structure of the migrants* in the period examined was marked by a higher share of women, because the possibilities of employing women in villages are smaller than for men. Exceptions to this rule occurred in some years during the industrialization of the country, that is in the second phase of the migration movements. The manufacturing plants opened in that period created a high demand for male workers. The percentage of women among the migrants, which amounted to 54% in 1960–1968, has changed from region to region. These differences are due to the type of manufacturing activities of the centres of absorption of migrants. Thus, in Upper Silesia, in the coal basin of Wałbrzych, and at Tarnobrzeg, men predominate among the migrants, whereas women predominate in the region of Łódź, a centre of textile industries, as well as in Warsaw, a city of extensive administrative and service functions.

A different picture of selection of migrants by sex results from an analysis of the outflow of manpower from agriculture. Here the share of men in the total number of migrants is twice as large as that of women. This results partly from the large share of what are called “peasant-workers”. They are, in fact, engaged in both non-agricultural and agricultural activities and thus are only potential migrants, in view of their permanent residence in the village.

Although there is a relatively higher rate of migration of women to towns, the index of their employment activity is decidedly lower than that of men. Out of 100 female migrants, only 50 are employed, whereas the corresponding figure among men amounts to 90.<sup>20</sup>

*The structure of employment of the migrants* shows that most of them work in the various sectors of industrial production (70%), and a smaller number (mainly women), are employed in state institutions concerned with administrative and service activities (22%).<sup>21</sup> The migrants prefer jobs in manufacturing, construction and transport. The present-day employment structure of the migrants is different from that in the earlier phases of migration in that it has a larger share of migrants in better-qualified jobs in manufacturing plants. This is a consequence of the fact that the higher level of education of the migrants in recent years has enabled them to complete studies at vocational schools. Owing to migration for educational reasons, the migrants have achieved a higher vocational training in the second and third phases of the migration movements. It is striking that the vocational training of the migrants was often higher than that of urban youth. This was confirmed by an investigation made at the Warsaw car plant, where the local young people usually obtained their vocational training by direct instruction at the work-place, whereas the rural immigrants could produce certificates of graduation from vocational schools.

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<sup>20</sup> J. Herma, op. cit., p. 147.

<sup>21</sup> M. Pohoski, op. cit., p. 128.

## FINAL REMARKS

In recent years the problem of migration from rural to urban areas has been frequently studied by specialists in different disciplines. In spite of this active interest, many questions remain to be answered. The Polish State is greatly interested in the problem of migration. It has taken over the initiative in directing population movements by exerting control over the labour market, wages, investment, housing, and the training of manpower. At the same time, the State finances the development of the study of migration.

Institute of Geography PAN, Warsaw

## PROBLEMS IN PLANNING THE RURAL-URBAN FRINGE, WITH SPECIAL REFERENCE TO LONDON

DAVID THOMAS

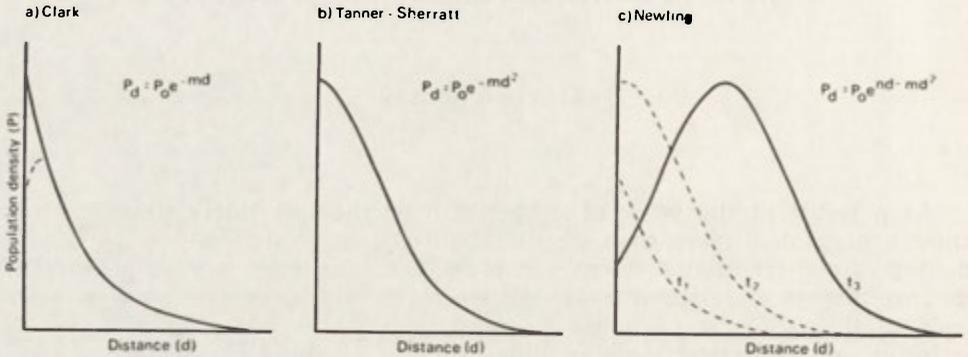
As a result of the work of urbanists over the last thirty years we now know a great deal more than we did about the development, form and functioning of non-traditional towns and cities. We cannot yet say with assurance that we always understand more, but we do have a clearer impression of the scale of the scholarly problems involved, and we certainly have better descriptive and analytical tools available for the eventual solution of the problems. But the recent surge of activity in urban geography should not be allowed to disguise the fact that many of the fundamental ideas are not new, and that quite a few were first outlined in the 1920s and 1930s, and for a while largely ignored.

### THE RURAL-URBAN FRINGE

All these generalizations are true of work upon the fringe areas of cities. As long ago as 1923 Burgess identified a fringe-belt in his well-known zonal model of a city [31], and in the 1930s, following earlier work, notably by Bleicher [6], Burgess [8] and Shaw *et al* [34], upon economic and social gradients, Charles Colby explored the two sets of forces which determine the general form of land usage and the distribution of functions within and around cities [11]. One set of forces, the centripetal forces, attracted certain specialized land-uses, such as offices, some types of retailing, and governmental activity, into the city centre. There they might maximize their accessibility to customers or to other closely-related activities with which they possessed strong linkages. Another set of forces, the centrifugal forces, drove out a different group of land-uses, including low-density residences and other activities of an extensive nature, from the city centre. They were inconsistent with the high land costs and congestion to be found there. It is the operation of these two sets of forces which underlies the contrasts between the centres and fringes of cities. Because they lead to regular, logical sequences of uses and functions with distance from the city centre, they have in turn produced the body of work generally known as "gradient analysis".

Simply, gradient analysis is a method of describing and generalizing urban structure. It is useful because sequences and changes can be identified, they can be described mathematically and by line-graph, and the results of the analysis have a broad predictive value because the relationships observed in

one city often hold true for others. One of the most widely discussed gradients, and also that one which is the most relevant in the present context, is the residential population density gradient attributable to Clark [10]. As the result of a study of the population gradients of thirty six cities, and using statistics ranging in time from 1801 to 1950, Clark was able to argue that regardless of the particular land-use arrangement within a city, and regardless of the date of the study, residential population density outside the central business area of a city declined as a negative exponential function of distance



$P_d$  is the population density at distance  $d$  from the city centre.  $P_0$  is the extrapolated central density,  $m$  is the density gradient, and  $n$  measures the instantaneous rate of change of density

Fig. 1. Theoretical urban residential population density profiles, after Clark, Tanner-Sherratt, and Newling

from the city centre (Fig. 1a). A logarithmic transformation of the curve produces a straight line. Two important points should be made about Clark's generalization. First, residential densities for the central areas of cities are extrapolated from the slopes derived from the outer residential areas. Since the central areas of most cities are occupied mainly by business and public buildings the hypothetical density used in deriving the equation for the gradient is often very much higher than the observed density. Instead of the solid curve shown in Figure 1a the density profile should more resemble the profile of a volcano cone (see broken line in Fig. 1a). Secondly, the values used for densities outside the central business area are usually calculated by taking the mean of all administrative or census districts that lie at roughly equal distances from the city centre. Since large metropolitan areas, particularly, have highly complex structures, with many subsidiary centres in addition to the main central area, it is likely that in most of the studies of large cities apparently regular population density gradients disguise quite important differences in urban form.

More recent work by Muth [25], Winsborough [48] Berry *et al.* [5], and by Clark himself [10], has confirmed Clark's original empirical observations. In addition, Alonso has provided an economic rationale for declining residential densities with distance from a city centre [2]. He suggests, to put it briefly, that the phenomenon may be regarded as resulting from the substitution by family units of transport costs for rents. But as the evidence improves so the suggestion has arisen that Clark's negative exponential model is not a fully efficient and conceptually relevant description of urban density gradients. For example,

Tanner [40] and Sherratt [35] have proposed that urban population densities decline exponentially as the square of distance (Fig. 1b), while Newling has suggested an alternative hypothesis which not only regards densities within and beyond the central business district as a continuum, but also provides a dynamic framework within which the emergence of a density crater in the central business area can be demonstrated (Fig. 1c, time periods  $t_1-t_3$ ) [27]. Most recently Kostrubiec [21], following a classification of towns by Gurevich and Saushkin [15] and developing work by Korzybski [20], has outlined a three-part profile, based upon density statistics derived from London and Paris, against which the current stage of expansion of smaller urban agglomerations can be matched.

Such controversy as exists is focussed upon the central areas of cities. There is, fortunately, substantial agreement upon the form of the urban density model towards the edges of the continuously built-up area. In an ideal situation, population densities decline as one moves outwards, house plots become larger, and eventually the urban area becomes fragmented and interspersed with land used for rural or sub-rural purposes. It is this zone of mixed elements and characteristics which has been termed "the rural-urban fringe". The zone is one where rural activities and rural modes of life are in rapid retreat and into which residential, commercial, educational, recreational, public service, and other extensive uses of land are intruding. Attention is now concentrated upon this fringe area.

#### AN AREA OF PROBLEMS

The rural-urban fringe was first specifically identified and described in the early 1940s. In a formative paper upon the fringe areas of American cities, and particularly of Indianapolis, Wehrwein was able to analyse the processes at work and to characterize some of the important features which developed [45]. He pointed first to the nature of residential growth. Flexibility of transportation between city edge and city centre encouraged, in the America of the inter-war years, a wild expansion of the main urban areas. Land agents and speculators rushed to lay out subdivisions for low-density dwellings, often in excess of the building plots which were demanded. Therefore, in addition to the great areas of built-up land which spread into the rural hinterlands of cities, the over-expansion of residential sites led to vacant, weed-covered land, expensively supplied with streets, water, sewers, gas and electricity, and for all practical purposes impossible to return to agriculture or any other rural use. Since such expansions took place in areas which had rural forms of government and lower densities than obtain in cities, the financial burden of unsold, unused, and unproductive lots was considerable.

The second characteristic feature of land-use stemmed from the recreational demands upon the urban fringe. Wehrwein describes with some gloom a situation on most urban fringes where land suitable for recreation had long been pre-empted for private use. Riparian land along lakes and streams was covered with summer cottages, resorts, taverns, dance halls, and fun-fairs. Roads leading to such resort areas were lined with established recreation areas and much pressure was exerted upon farm land by hunters in search of game. Nowhere, it seems, were the conflicts between farmers and the remainder of the population greater than in the areas close to cities.

The third characteristic of fringe land-uses recognized by Wehrwein was the result of institutional factors. For convenience, and because of their space

requirements, many of the public utilities serving cities became located in the rural fringe areas. Recreation land, water supply and radio stations, sewage-disposal plants, airports, and cemeteries were therefore among the urban necessities found beyond the outer edge of the city. But in addition to these uses, there were others, necessary but unwanted in the city, which it had been the practice of cities to force into rural territory by ordinances excluding them from the built-up area as such. Slaughter houses, wholesale oil storage, noxious industries of all sorts, junk yards, caravans and caravan parks, taverns and dance halls, sub-standard dwellings, carnivals, and the sale of fireworks had all been subject to restrictive city legislation at one place or another. Such activities escaped urban control by locating in the nearby countryside where rural authorities had neither the powers nor the resolve to take action.

Wehrwein's pioneering study has been followed by many others. A large number of authors, such as Balk in his work on Worcester, Massachusetts [4], have provided detailed descriptions of the fringes of particular towns or cities while some, like Andrews [3], have attempted to identify the general land-use characteristics of rural-urban zones. Others have paid attention to more limited aspects of rural-fringe areas. For example, Myers and Beegle [26], Blizzard and Anderson [7], and Pryor [32] have attempted to define and delimit the rural-urban fringe, Fellman [12] has considered the alterations to the geography of areas close to a city which take place in advance of development, Firey [13] has studied the social and planning implications of rapidly-developing zones around cities, Masser and Stroud [22] have written about the influence of commuters upon rural areas, Pahl [30] has looked in great detail at the social contrasts which arise in urban-dominated rural societies, Roterus and Hughes [33] have described the problems for local government which occur on urban peripheries, and Whitehand [46] has attempted to recognise the fringe belts of earlier periods in the urban form of present-day cities.

The literature on the rural-urban fringe is now both copious and diverse. But while many different aspects have been covered from many different standpoints, there is virtual unanimity in regarding the rural-urban fringe as a problem area. It provides substantial scholarly problems of definition and of analysis. It also presents perhaps more pressing practical problems which, if unsolved, detract from the quality of lives of both those who dwell in the fringe and those who live in the nearby city.

Six main categories of problem emerge. First, there are those which stem from the scattered and piecemeal residential and commercial development that often occurs on unplanned urban fringes. The problem has a number of dimensions; it is partly one of amenity, partly one of organising and articulating small, often straggling settlements, and partly one of the impact of loosely-knit development upon nearby rural land uses. Secondly, there are the difficulties which arise from the intermixture, on urban fringes, of non-conforming land uses with the more acceptable activities. Whether the non-conforming uses have been attracted by the space and lower land values of the fringe, or have been forced to move from their city sites because they are in some way noxious or undesirable (they can hardly be more desirable in a rural context), they create conflicts and pressures when juxtaposed with rural and with suburban land. Thirdly, there are the problems of reserving land for agriculture and maintaining it in economic use. Agriculture is in a weak competitive position in the urban fringe and the agricultural area is easily fragmented by urban-based uses [47]. Fourthly, and in their nature

very similar, a group of problems arise over the reservation of land for recreation. Demands for such land are felt very close to the outer edges of towns and cities and the competition with residential use is severe. Fifthly, there are a set of difficulties which stem from the high costs of services to scattered settlements. Costs are not great compared with truly rural areas; they are simply high in comparison with the comparable figures for the nearby urban mass. Usually high costs lead to a lower level of service provision, which is what really highlights the problem. Lastly, there are the difficulties which follow from the intermixture of social groups, some with urban-based and others with rural-based attitudes and ways of life. This set of problems is the only one of the six which shows any signs of abating. Modern means of communication, including radio and television as well as transportation, have greatly eroded true rural society, and even the indigenous and rurally-employed population of the rural-urban fringe is rapidly becoming urban-oriented.

It is not surprising that in areas which experience such formidable problems, attempts should have been made to exercise some control over land-use development. In North America, where much of the early work upon the largely uncontrolled city fringes was undertaken, the move to organize extra-metropolitan growth has been relatively recent (for example around Minneapolis-St. Paul [42]). In Europe there is a longer tradition of such attempts, among which those in the United Kingdom, notably in respect of London's fringe, have been prominent.

#### CONTROLLING LONDON'S GROWTH

Some of the main problems of population expansion in Britain have already been discussed in earlier Anglo-Polish Seminars (for example, the papers by Henderson, [17] James [19], Osborne [29] and Smailes [36]). Britain has long been one of the most urbanized countries of the world. But while total population is increasing fairly rapidly (4.1% between 1951 and 1961) many rural areas have stable or even declining totals, and the older industrial areas, based largely upon the coalfields, are not retaining their natural increase. The major expansion is taking place in the Midlands and South-east England, and here the most dynamic areas are those on the fringes of the big towns and cities. Not only is natural growth high, but gains by migration have also been substantial. Population movements have taken place from the less fortunate parts of the country in the west and north, though in the last few years these flows appear to have weakened. But more immediate in effect, and certainly undiminished, have been the shorter-distance movements from city centre outwards. The result has been that many semi-rural areas on the fringes of London and other cities have increased their populations by between 20 and 40% in recent decades.

The controls over land use which have been devised to meet the problems are primarily preventative. Principal among these is the "green belt"; a zone of land in which very little new building is allowed, but within which undeveloped countryside is maintained so that the recreational and other open-space deficiencies of the urban area may be met [44]. Building which is prevented in green belt must, of course, take place beyond it and the "New Town" and "Expanded Town" policies have evolved as an organized means of absorbing at least some of this forced overspill.

Again these ideas are not new. As London has grown — and the degree

to which its growth has approximated to the models discussed above is revealed in the logarithmically-transformed population-density profiles shown in Figure 2—so increasing concern has been felt about the problems of its fringe and the organization of its dependent region. Towards the end of the last century a number of public figures, most of whom had a close association with the newly-created London County Council, had made concrete proposals for the establishment of green girdles or parkway rings [41]. Ebenezer Howard's garden-city movement [18] was also a great stimulus, since an integral part of the garden-city system was a country belt, the purpose of which was to control the growth of a city so as to preserve agriculture (and hence the city's food supply), to promote amenity, and to retain space for recreation [28]. Later, in the 1920s and 1930s, the continued growth of London and the loss of potential recreation land caused deep misgivings, and, after

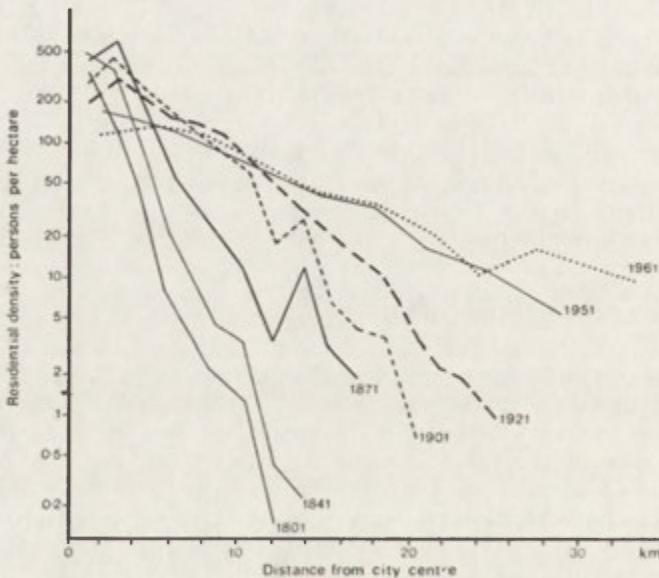


Fig. 2. Residential population density profiles—London 1801–1961 (after Clark)

several suggestions for remedy had been rejected, or simply “shelved”, an advisory local authority regional planning committee was established. The committee had the good fortune to appoint Sir Raymond Unwin as its technical adviser and he proceeded to prepare what, in effect, was the first comprehensive, though outline, plan for London and its region [14]. This contained proposals, among other things, for a continuous parkland belt around London and this, in principle, was eventually adopted by the London County Council and safeguarded by an Act of Parliament.

But it was the general thinking behind Unwin's plan, rather than its detailed proposals, that had most lasting effect. Unwin's strategy was adopted by Sir Patrick Abercrombie when he, in turn, came to draw up an advisory plan for London in the 1940s [1], and it is from the Abercrombie plan that most of the planning ideas on the London region have been derived up to quite recently. Abercrombie viewed London and its region as composed of a number of concentric zones. The inner ring was badly congested and in

need of redevelopment. From this area population would have to move outwards for resettlement under better conditions. The suburban ring, which covered the outer parts of the conurbation, would remain virtually static. Beyond it lay the green belt ring, a zone in which land was substantially undeveloped, and in which communities still maintained some semblance of individuality. Most distant from London was the outer country ring, where greatest provision was to be made to accommodate overspill from the conurbation. It was here that the new towns and expanded towns were to be built.

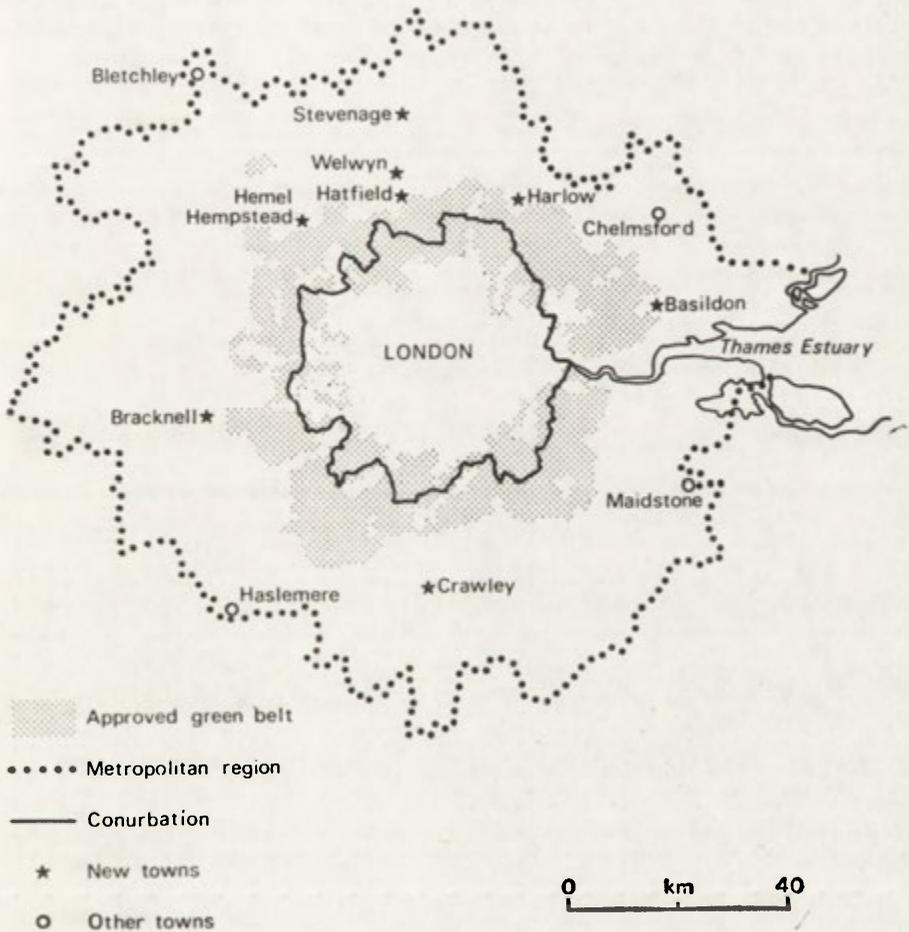


Fig. 3. London's Green Belt

Abercrombie's vision of the future urban fringe was completely consistent with the Scott Committee's Report on Land Utilization in Rural Areas [24]. It was also quite in tune with the professional planning outlook of the day, in which the great anathema was "urban sprawl", or "ribbon development". The green belt was intended to retain an open zone of land, girdling the built-up area, where the main activities would be rural, though there might also be non-rural, but appropriate, uses (that is, urban-based, but involving only a minimum of developed land), such as recreation. The belt was to be

10–15 km wide. Though most of the land would be privately owned, control would be exercised by the regulation of new development. Within a few years of the publication of the plan, legislation had been enacted which made it possible to put Abercrombie's proposals into effect. After long discussion between the local county planning authorities and the planning ministry a revised, and slightly expanded, version of the green belt was eventually agreed and embodied in approved development plans during the middle 1950s. It is this approved green belt which is shown in Figure 3. Since that time green belts have been designated around a dozen or more British towns and cities, and these are currently passing through the various stages of approval. Major extensions have also been proposed to London's green belt, but so far none of these has been approved, and it is unlikely that any will be.

### GREEN BELT INGREDIENTS

Since the British system of land-use planning depends upon control over new development, it follows that the impact of the green belt has, in a sense, been rather negative. Its effect has been largely (but with some important exceptions) to fossilize existing uses in the rural-urban fringe while at the

TABLE 1. Net changes in land usage on London's fringe, 1960–1966

Land Use	Approved green belt*		Change* (%)	All land within study area*		Change* (%)
	%			%		
	1960	1966		1960	1966	
(1) Residential and commercial	6.2	6.6	+6.4	14.3	14.9	+4.2
(2) Manufacturing	0.2	0.2	+2.6	0.7	0.8	+7.4
(3) Extractive	1.8	2.4	+29.8	1.6	2.1	+32.6
(4) Transport	1.5	1.7	+11.7	2.1	2.3	+7.8
(5) Public Services	0.9	1.0	+10.5	1.2	1.3	+6.7
(6) Institutions standing in extensive grounds	1.1	1.1	+2.3	1.4	1.5	+4.3
(7) Woodland	11.8	11.7	-1.2	10.3	10.2	-1.1
(8) Water	0.6	0.6	0.0	0.5	0.5	0.0
(9) Recreational	6.2	6.5	+4.8	5.4	5.6	+4.3
(10) Agricultural	69.5	68.0	-2.1	62.3	60.6	-2.7
(11) Unused	0.2	0.2	-7.2	0.2	0.2	-4.8

\* Rounded to one decimal place

same time shifting the natural growth of London further outwards. Though no one has yet drawn the current diagram accurately, there must now be a pronounced trough in the population density profile where it cuts the green belt between 20 and 30 km from central London. It appears to be emerging in the 1961 profile in Figure 2.

The land-use composition of the green belt looks good or bad depending upon personal attitude, and the particular statistics inspected. An attempt is made in Table 1 to set the record straight by showing, for eleven major ca-

categories of land use, the percentage of green belt taken in both 1960 and 1966 [43]. The figures are calculated in two ways. First, statistics are presented for land actually designated as green belt in approved development plans. They take no account of the major urban, commercial, and industrial areas excluded from the green belt, yet an integral part of it, by the drawing of green belt boundaries. It will be observed, even in a map of the scale of Figure 3, that there are some substantial excepted areas. Secondly, statistics are presented for all land beyond the continuous inner edge of the green belt and within a study area which includes not only the excepted areas within the green belt, but also some of the major urban areas lying on its outer edge which have been excluded in development plans by diverting the outer boundary of the green belt inwards. While the first gives a true impression of the composition of the approved green belt, the second provides a more comprehensive view of the uses to which land is put on London's fringe, and therefore of the pressures and competition which exists between uses.

Categories 1 and 2 may be thought of as the undesirable uses, judged by orthodox green belt standards. Categories 3-5 are those which, though undesirable, may have to be accepted as inevitable for economic, space, or purely practical reasons. Categories 6-10 are the approved uses; the last category is for land under no active use at the date of the survey. When the approved green belt alone is considered, the picture which emerges is very satisfactory. Together the non-conforming activities, some of which are temporary and others inevitable, cover less than 12 per cent of the approved green belt, while agriculture and the remaining conforming uses dominate. When all land is accounted for the picture alters dramatically, since most of the areas excluded from the green belt are urban in character. The non-conforming uses are now seen to occupy over 21% of the fringe zone and agriculture only a little over 60 per cent.

Land-use changes over the period 1960-1966 are also revealing. The first two categories, land occupied for residential and commercial purposes, and for manufacturing, are those which are regarded as undesirable uses. It is clear they have been contained reasonably firmly. Though there are some differences in the rates of growth between approved green belt and all land, these are largely explicable in terms of the amounts of "white" land remaining in the green belt, and of the attraction of manufacturing to, and expansions within, the major urban centres. The next three categories, extractive industry, transport land, and public service land, while in principle undesirable in a green belt, are those which have long been regarded as inevitable. This attitude is plainly reflected in the statistics. There is heavy pressure upon land for these extensive activities, and much of the demand can only be satisfied in the green belt. The growth of the extractive industries (largely sand, gravel, and chalk working) is the most dramatic—an increase in area of almost one-third in six years—but transport and public service land has also expanded in an unrivalled way in the period under study. The approved categories, institutions standing in extensive grounds, woodland, water, recreation and agriculture, are notoriously poor competitors for urban-fringe land. Greatest local demand exists for institutional land (mainly for schools and hospitals) and for recreation space. These uses show small increases between 1960 and 1966. The remainder are static, or in decline, with agriculture contributing most of the land appropriated by the expanding uses.

There emerges what, in the circumstances, is a not too surprising paradox. Land uses which, both by general consent and by Planning Ministry pro-

nouncement, are considered ill-suited to the aims of any green belt are expanding rapidly, due to local pressure upon space and to the strength of their competitive positions. Land uses which are fully conforming and widely approved in a green belt context are expanding less quickly or are, in fact, contracting.

In the 1960 survey it was possible to identify for three land-use categories rates of change over the period 1955–1960. These have been set against changes in the same three categories over the period 1960–1966 in Table 2. It should be noted that the first period is composed of five years and the second of six. The comparison puts recent changes in the green-belt area into perspec-

TABLE 2. A comparison of certain land-use changes on London's fringe in three period 1955–60 with those in the period 1960–1966

Land Use	Changes in the approved green belt*		Changes in all land within study area*	
	(%)		(%)	
	1955–60	1960–66	1955–60	1960–66
(1) Residential and commercial	+5.0	+6.4	+9.5	+4.2
(2) Manufacturing	+17.2	+2.6	+16.3	+7.4
(3) Institutions standing in extensive grounds	0.0	+2.3	+7.3	+4.3

\* Rounded to one decimal place

tive. Residential and commercial land has continued to expand in the green belt proper at almost exactly the same rate as in the period 1955–1960, though when all land is accounted the rate appears to have halved. This is confirmation of an earlier suggestion that dwindling stocks of “white” land are curbing housing development in the areas excluded from the green belt. The expansion of manufacturing land was very modest compared with that of the earlier period. It should be remembered, however, that the amount of manufacturing land is very small, so that even quite substantial changes in rates of change may not mean too much on the ground. The intensification of the use of existing sites may be a far more important feature to study. But it is notable that the change of rate for all land is less than for the green belt alone. Institutions, on the other hand, seem to share the characteristics of residential and commercial land. With little “white” land remaining, they too are overspilling from London and from the towns of the green belt into the rural fringe area, a feature which was completely absent during the period 1955–1960.

A number of pointers seem to emerge from the comparisons made above. First, the green belt is far from wholly green and, in fact, already contains a higher proportion of the non-conforming land uses than occur in the country generally. Secondly, there is clear evidence that the non-conforming land uses, particularly those associated with extractive working, transport, and the public services, are expanding much more rapidly than any other uses. Thirdly, there seems to be a change of emphasis in where new developments take place. Little “white” land is available for building and both approved and non-conforming land uses appear to be overspilling into rural areas.

THE FRINGE OF THE FUTURE

The green belt, it can readily be seen, is not itself without its difficulties. In attempting to solve some of the problems of the rural-urban fringe by controlling the location and the mix of land uses, an attempt has been made, perhaps unwittingly, to alter the operation of what are clearly strongly-acting mechanisms leading to well-established relationships. These are the relationships which have been represented above in the form of gradients.

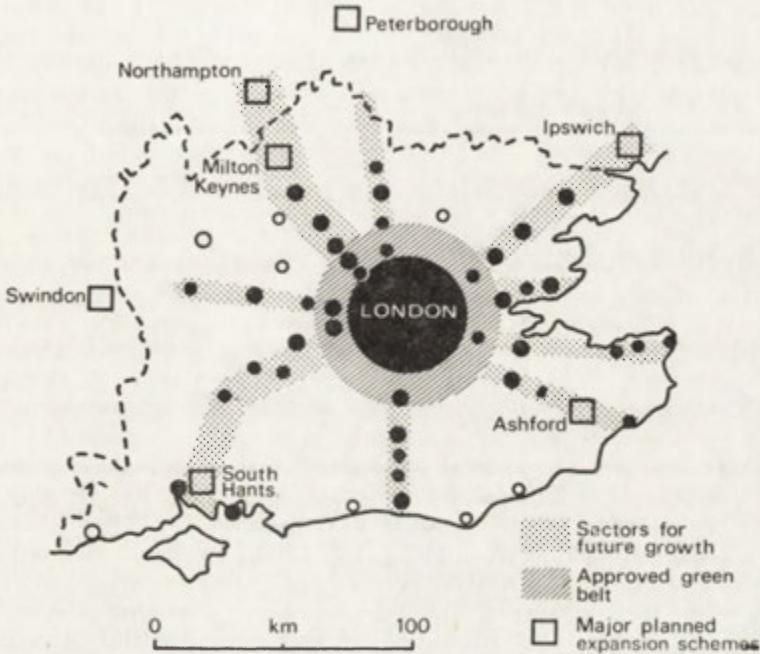


Fig. 4. Strategy for South-East England

Viewed broadly, the green belt may be said to have achieved its aims, but it would be less than frank to pretend that there have not been internal tensions, or that, together with its complementary policies and techniques (the building of New and Expanded Towns, for example), it has coped completely adequately with the wider problems of a rapidly growing South East Region. These facts, together with changes in method and fashion overseas [16], have led recently to a rethinking of regional policy for the London area.

*The South East Study, 1961-1981* [23], a wide-ranging investigation into the problems of the South East Region carried out by the Planning Ministry in the early 1960s, is essentially orthodox in its approach. In many ways it is the Abercrombie plan on a larger scale. It recognises and defines the population pressure in the region and proposes to accommodate the projected increases partly by normal additions to existing settlements, controlled by the usual planning processes, partly also by creating a second generation of new and expanded towns, conceived on a much larger scale and sited further

from London than the new towns of the late 1940s. It was hoped that the new settlements would act as counter-magnets to London and draw away both population and economic activity from the overcrowded and overcentralized conurbation. In this scheme the green belt was still integral, though it was suggested that small and inessential areas might be released for building.

Early in 1965 new economic planning regions were defined. Within each region the Secretary of State for Economic Affairs appointed an Economic Planning Council, the duty of which was to act as an advisory body to the government upon economic and physical planning. In the South East Region the Council was both swift and radical. It was the first to produce a long-term physical plan for its area; a plan which was remarkable because in a number of respects it suggested major departures from earlier thinking.

Instead of the series of scattered overspill centres, large and small, proposed in *The South East Study, 1961-1981* the Council envisaged a pattern of development based upon sectors following the main radial routes out of London [37]. Substantial growth corridors, sometimes up to twenty miles (32 km) wide, led urban and industrial development towards the major expansion areas of Ashford — East Kent, Ipswich — Colchester, Northampton — Milton Keynes, and Southampton — Portsmouth. Minor corridors stretched in the direction of Brighton, Hitchin, and Southend (the strategy is shown diagrammatically in Fig. 4). The existing green belt, it was suggested, should be retained and the physical extension of London restricted. Green “buffers” were recommended between the growth sectors and also between individual urban agglomerations within the sectors, and a number of largely rural areas were proposed as “Main Country Zones”. In choosing a corridor plan the Council clearly indicated its feeling that a different strategy was required. It was a change of emphasis designed to bring the development of the London region very much closer to that planned for Copenhagen, Hamburg, Paris, Stockholm, and Washington D.C., than to the model outlined by Abercrombie and his predecessors.

Shortly after the publication of the Economic Planning Council's proposals the South East Joint Planning Team was set up in the Planning Ministry to review the relative merits of the alternative strategies for London and its region, and to produce a new regional plan. A statement of progress was published late in 1969 [38] and a full report, the *Strategic Plan* [39], appeared early in 1970. The report follows neither of the earlier alternative strategies closely. It deliberately sets out a highly flexible system in which growth points of varying size, and at varying distances from London, are envisaged in most sectors of the Metropolitan Region outside the green belt. Nonetheless, it is the clear intention that growth should be more sharply focussed than at present. It is possible that if the substance of the strategy is eventually adopted, major developments will take place far closer to London than suggested by any of the previous plans. For example, there are proposals for three large-scale expansions, accommodating between them over 2.5 million people, near Bracknell, Crawley and Basildon. These growth points lie immediately beyond the present approved green belt and in a zone that is already undergoing rapid urbanization (Fig. 3).

The new outline plan is still subject to discussion and possibly to further revision. But whatever the outcome, it is too much to expect that all the planning problems of London's rural-urban fringe will finally be solved. At best, hopefully, a new plan will bring a fresh order, will reduce land-use conflict,

and will go some way towards maximizing the personal welfare of the population of the region. In an area where such dynamic social, economic, and geographical forces interplay, this will be achievement enough.

Saint David's University College, Lampeter

#### *Acknowledgment*

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## THE DEVELOPMENT OF LONG-DISTANCE COMMUTING INTO LONDON

H. PATRICK WHITE and GARTH D. S. GODDARD

The fundamental problem of transport in London is to provide for the daily movement of about 1.2 million people into and out of Central London,<sup>1</sup> an area of some 6.5 square miles (15.4 square kilometres). As the Buchanan Report<sup>2</sup> clearly demonstrated, even a greatly improved road system and parking capacity could cope with only a small proportion of these journeys to work. In 1967 less than 12% of peak period trips to Central London were by private car, the rest being by public transport. Considerable investment is thus necessary in railway track, signalling and rolling stock to provide capacity for peak hours, and this is under-used for most of the day.

In recent years a number of analyses of commuter travel to Central London have been published, based on the Registrar General's Census of Population of England and Wales. These considered movement from all Local Authority areas within a given distance from Central London in order to build generalised models. Regression analysis has proved a useful tool in determining the factors which influence the level of commuting. Wabe,<sup>3</sup> using 15 variables, found that the proportion of residents in the higher socio-economic groups was the most important variable in influencing the level of commuting from a Local Authority area, reflecting the dominance of "white collar" employment in Central London. These studies have also indicated the significance of journey time, train frequency and availability of employment locally.

Though the majority of the commuters come from the built-up area which extends for about 15 miles (24 km) from the centre, and which is designated Greater London in the South East Study,<sup>4</sup> a minority that is substantial in total comes from outside. These commuters originate in the Outer Metropolitan Area (OMA), extending for up to 40 miles (65 km) from the capital, and also to an increasing extent from the outer parts of the South East Region. With the improvement of rail services during the 1960s it now becomes possible to commute daily to London from places as far away as Bournemouth, Swindon, Coventry and Birmingham (i.e. up to about 100 miles, 160 km).

<sup>1</sup> London Transport Board, *London Transport in 1962* (1963), p. 24.

<sup>2</sup> C. Buchanan et al., *Traffic in towns* (London, H.M.S.O., 1963).

<sup>3</sup> J. S. Wabe, Commuter travel into Central London, *J. Transp. Econ. Policy*, 3 (1969), 48-68.

<sup>4</sup> Ministry of Housing and Local Government, *The South East Study* (London, H.M.S.O., 1964).

Long-distance commuting has not received much attention in the literature,<sup>5</sup> though a number of studies are now being made by Planning Authorities, by British Rail (B.R.) and by Universities such as Salford. The commuters live to some extent in towns but also in villages and even in houses scattered through the open countryside. This provides a reason for the paper to appear in a symposium on rural-urban inter-relationships.

## THE DEVELOPMENT OF LONG-DISTANCE COMMUTING

Long-distance commuting, which we have defined in the case of London as being a regular journey to work 4 or more times a week from beyond the built-up area, originated among the more wealthy of the population at a relatively early date. Country houses up to 15 miles (25 km) out of London were occupied during the 18th century by men still active in commerce, and William Cobbett in 1818 mentions commuting "stock jobbers" living in Brighton and doing financial business in London. But the spread of long-distance commuting really depended on rail transport.

Right from their opening some of the railways set out to encourage long-distance commuting. The London and Croydon, from 1839, offered contracts or season-tickets<sup>6</sup> and provided fast trains up to London in the morning and down again at night. By 1845 first class season-ticket rates were being quoted from Brighton to London (50 miles—80.45 kms) at £12 per month or £50 per year, and in 1841 an express was scheduled to leave Brighton for London at 0830 hours, taking 1<sup>3</sup>/<sub>4</sub> hrs.

The mass movement of commuters began after 1860,<sup>7</sup> when, as a deliberate policy, the Great Eastern Railway provided a lavish train service at very low fares from North East London into Liverpool Street Station. This led to the spread of commuting among clerical and skilled manual workers for the first time, and initiated the rapid outward spread of the continuously built-up area up to 1914. The trend continued even faster between 1920 and 1939 owing to railway electrification and to the popular demand for low-density suburban housing. This led to a general increase in the length of journey to work and also in long-distance commuting as we have defined it. An example of the consequences upon train service patterns is shown in Fig. 1.

The outward growth of the built-up area was not resumed after World War II at anything like the same rate, owing to the rigid planning policy of maintaining a Green Belt. Growth has consequently been taking place discontinuously in the towns, villages and open countryside beyond London's Green Belt. This pause in the outward spread of the built-up area enables us to study trends in long-distance commuting more easily; for what were in 1925 long-distance commuting areas had been merged with the built-up area by 1935, but areas that were long-distance in 1945 have remained long-distance in 1970.

<sup>5</sup> But see, R. E. Pahl, *Urbs in rure: the Metropolitan fringe in Hertfordshire*, London School of Economics, Department of Geography Research Paper, No. 2 (1965); P. G. Hall, Planning for urban growth-metropolitan plans compared, *Reg. Stud.*, 1(1967), 101-134.

<sup>6</sup> Contracts or season tickets are tickets issued for periods of one week, one month, or three months which allow daily travel at reduced rates.

<sup>7</sup> For a detailed historical account see: H. P. White, *A regional history of the railways of Great Britain*, vol. 3: *Greater London* (Newton Abbot, 1971—2nd edit.).

To take two examples of post-war growth. In 1957 the number of commuters travelling from Tonbridge ( $29\frac{1}{2}$  miles — 47.48 km from London) was 1160 and from Tunbridge Wells ( $34\frac{1}{2}$  miles — 55.5 km) the number was 1350. By 1963 the numbers had increased to 2300 and 1800 respectively.

The distances involved, together with road congestion, are generally sufficient to deter commuters from driving to work by car. The railway is therefore used for the journey to work by all but a small minority of those from the

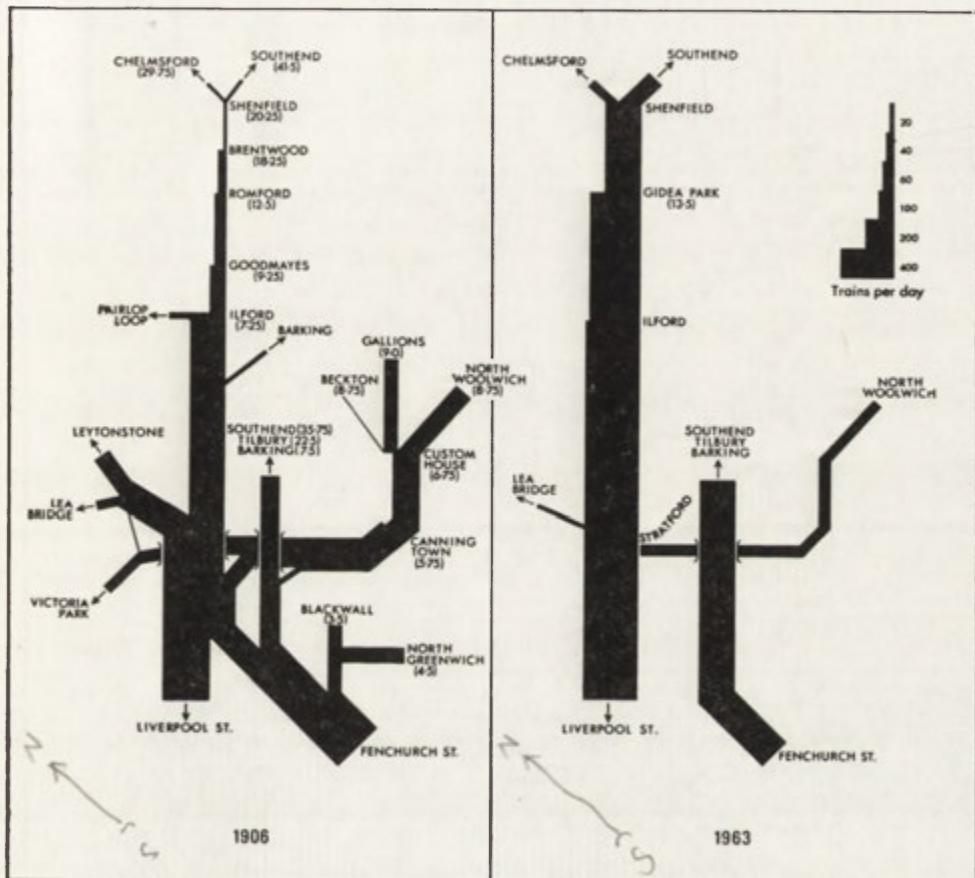


Fig. 1. The development of suburban services in East London, 1906–1963. Figures in parentheses show distances in miles from terminus. Numbers of trains are for weekday services. All trains making two or more stops within the area have been included. Note the decline in inner-suburban services and the increase in outer-suburban services

Source: Timetables for the relevant years. Diagram first appeared in H. P. White, London's Rail Terminals and their Suburban Traffic, *Geogr. Rev.*, 56 (1964), 347–365.

Outer Metropolitan Area and beyond who are employed in Central London. The result is that journeys to work by B.R. train into Central London have increased in volume and in average length. Long-distance commuter trains fill up outside the Green Belt and travel into the London termini with few, if any, suburban stops. They are of greater financial benefit to B.R. than the

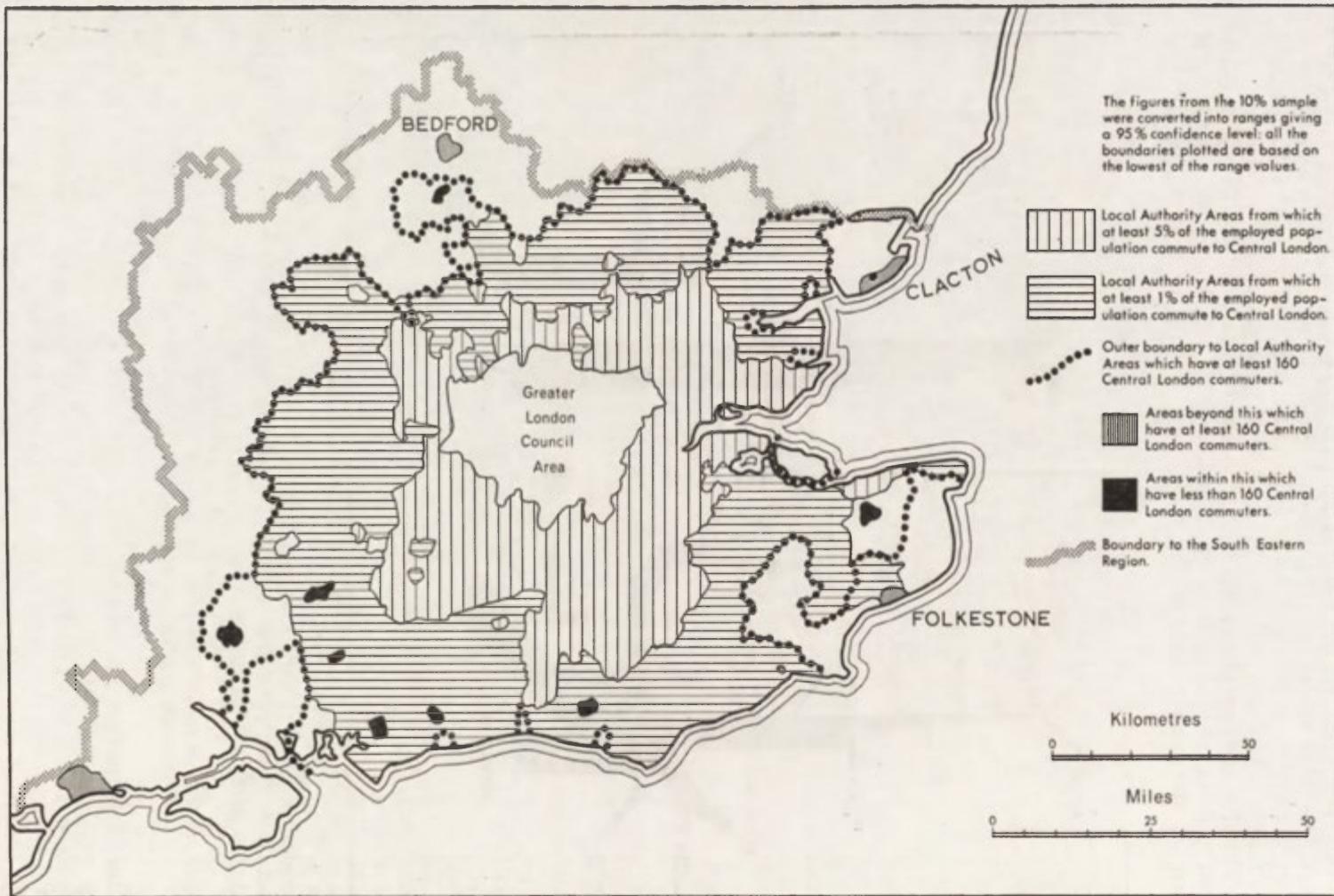


Fig. 2. The South Eastern Standard Region — Commuting levels by Local Authority areas  
 Source: Registrar-General, *Sample Census of England and Wales, 1966: Workplace and Transport Tables* (H.M.S.O., 1968).

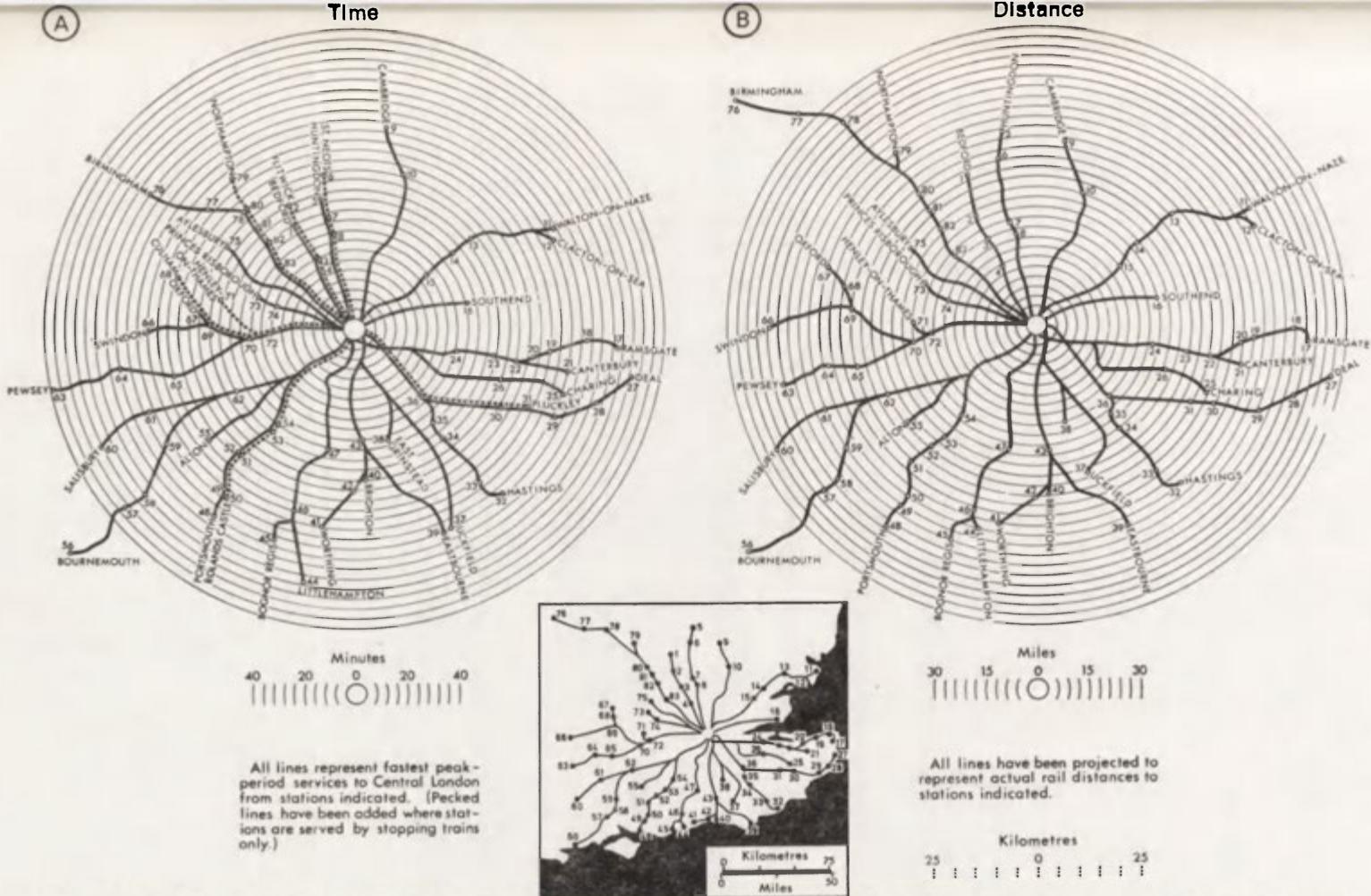


Fig. 3. Main long-distance commuter routes to London, drawn on (A) Time and (B) Rail-distance scales. The inset map shows the actual configuration of routes and stations

suburban services, which are slower and may not have maximum loadings until the final few miles of their journeys.

A general picture of long-distance commuting in the London Region is given in Fig. 2. The boundary showing Local Authority areas which have at least 160 Central London commuters has been chosen, because this figure would seem to be the lowest accurate figure obtainable from the 10<sup>0</sup>/<sub>0</sub> Sample Census of Population, 1966.<sup>8</sup>

When this map is compared with Fig. 3 we can observe that extensions of the commuter region occur where the railways provide a fast service to the capital. This is most noticeable in the counties of Kent and Sussex where corridors of commuter development occur along the Ramsgate, Deal and Hastings routes, while in N. E. Essex, extension of the commuter area is shown along the line to Clacton, which was electrified in 1963. Outlying areas with significant numbers of commuters occur at a number of points (for example Clacton, Folkestone and Bedford), indicating that these towns have a number of non-stop business services and are closer to London in terms of time than places which are nearer but which are served by slower trains.

## FACTORS INFLUENCING LONG-DISTANCE COMMUTING

### (i) TIME-DISTANCE

Distance is of importance only indirectly, affecting the time and the cost of the journey to work. But these latter do not always vary in direct proportion with distance. Other things being equal, the less time spent on the journey the better and the long-distance commuter may prefer to travel to a place further away which may be reached in less time.

Residential development may take place further away from London because trains to London take less time than from places nearer the capital. The spread of long-distance commuting has been encouraged since 1960 by increased

TABLE 1. Morning commuter services to London from

	Basingstoke	Southampton	Clacton
<u>Before electrification</u>			
No. of trains	5	1 <sup>1</sup>	6
Average time (minutes)	73	116	101
Time of fastest train	51	116	85
<u>After electrification</u>			
No. of trains	9	4 <sup>2</sup>	5 <sup>3</sup>
Average time (minutes)	51	77	92
Time of fastest train	43	73	85

- (1) +3 slow services taking 140 minutes
- (2) +a number of slow services
- (3) +6 services starting at Colchester or Witham

Source: British Rail timetables.

<sup>8</sup> Registrar-General, *Sample Census of England and Wales, 1966: Workplace and Transport Tables* (London, H.M.S.O., 1968).

speed of trains owing to electrification. Some examples are given in Table 1. The most spectacular increases have been on the main lines from Euston and from Liverpool Street to Clacton, and also on the Southern Region lines to North-east and East Kent. In addition, the provision of diesel traction has greatly speeded up trains to the OMA from St. Pancras and Paddington termini.

However, if the minimisation of the journey-to-work time were the only factor considered in his selection of residence, the Central London worker would presumably live in the inner London suburbs. Clearly other factors are equally important.

## (II) COST

The cost of the journey to work is also relevant. It was the low fare policy of the Great Eastern Railway which led to the spread of lower-middle class and working-class commuting. In South Essex the impoverished London, Tilbury and Southend Railway attempted to stimulate residential traffic by very low fares, a policy continued by its later owners. The main effect was to stimulate growth of suburbs such as Barking and Upminster and long-distance commuting traffic from the town of Southend. But after 1920 it also led to a curious form of suburban development centred on the stations at Laindon and Pitsea (west of Southend). Land values were low and unplanned growth of bungalows, huts, and old railway carriages spread outwards along a maze of muddy roads from the stations. They stood on smallholdings of an acre or so (0.5 ha) which were too small to provide a living and therefore cultivated as a sparetime occupation by pensioners and commuters.

TABLE 2. Services from Euston

Group	To Euston from:	Distance (miles)	Fastest peak time	Monthly season rate 1970	No. of season-ticket holders from Midland stations to London 3/1970
A	Watford	17.5	19 min	£7.65	
	Hemel Hempstead	24.5	26 min	£9.50	
	Bletchley	46.75	43 min	£12.50	
B	Northampton	65.75	67 min	£15.35	71
	Rugby	82.5	64 min	£18.5	66
C	Coventry	94.0	74 min	£19.55	68
	Hampton-in-Arden*	100.75	84 min	£20.75	39
	Birmingham	112.75	96 min	£21.75	34
	Wolverhampton	125.75	119 min	£23.5	4

\* Railhead for Birmingham/Coventry suburbs of Kenilworth, Knowle and Solihull

Source: British Rail, London Midland Region

Season-ticket rates have always shown a very pronounced taper with distance and this has provided an incentive to commuters from long distances. Thus in 1966 the rates between the London termini and Bexley (south-east of London, 14 miles — 22.5 km) were £15.85 for three months. But between London and Herne Bay (North Kent, 61.5 miles — 99.0 km) they were £38.70. Though the distance was more than four times as great, the cost was less than 2.5 times as great.

The effects of the season-ticket taper are shown very clearly on the high-speed electrified line between Euston and the Midlands. Rates and times are shown in Table 2. Birmingham to Euston is six times the distance from Watford to Euston, while the season-ticket rate is less than three times as much. Daily journeys to work of about 100 miles (160 km) are quite feasible on these high speed services. A recent survey by one of the authors has shown that 70% of the season ticket holders travel to London at least five times a week. The fast trains provide a more comfortable and reliable service than those on suburban routes closer to London. It would seem from the initial findings of the survey that the comfort of commuter services is becoming a significant factor in the choice of an area of residence.

### (III) FREQUENCY

On suburban rapid transit lines<sup>9</sup> it is important to maintain a service interval of no more than 10 to 15 minutes, so that passengers may go to stations without having to consult the timetable, knowing that the train will arrive within a few minutes. This is not feasible on long-distance services. Long-distance commuters are therefore familiar with the peak-period timings of their trains and many of them catch the same train each day. Nevertheless, if only a single business service is provided it may not be at a convenient hour. To arrive early at a place of work is equivalent to adding that much time to the journey. However, on virtually all lines from London a basic service of at least once an hour is provided, with extras at peak hours. This aspect of quality of service may therefore be discounted as leading to differential developing of long-distance commuting as between one line and another.

### (IV) HOUSE PRICES

Of the non-transport aspects, the price of houses is probably the biggest influence. A similar house costs less in the OMA than in the Greater London Area, particularly in the smaller non-industrial towns and in the villages. In 1966 in Bexley, which is 10-14 miles (15-23 km) from London, the average cost of a 3-bedroomed detached house was £6,650. In Whitstable and Herne Bay (E. Kent) (56-63 miles or 90-101 km) the cost was £5,050, and further out, in Margate, £4,700. It has also been suggested<sup>10</sup> that houses in the Ashford area (56 miles—90.1 km) cost up to £1,000 less than similar houses in the London suburbs. Prices do, however, vary greatly, even between areas of long-distance commuting. There is thus a marked difference in price between Herne Bay 61½ miles (99 km), from which large number of commuters travel, and Margate (72½ miles—116.7 kms), from which comparatively few travel. There is thus much scope for research into differences of house prices.

### (V) MISCELLANEOUS FACTORS

There are a number of factors which control the number of homes available and the supply of land for further houses. Prior to 1939 the main growth areas of long-distance commuting were in certain "traditional" areas (Fig. 4).

<sup>9</sup> Rapid transit railways are specialised lines on which urban and suburban passenger traffic is moved by a frequent service of electric trains making frequent stops. All other traffic is excluded.

<sup>10</sup> P. S. Smith, *Rail commuting in the Ashford area*, University of Kent at Canterbury, Centre for Research in the Social Sciences (1968, mimeo).

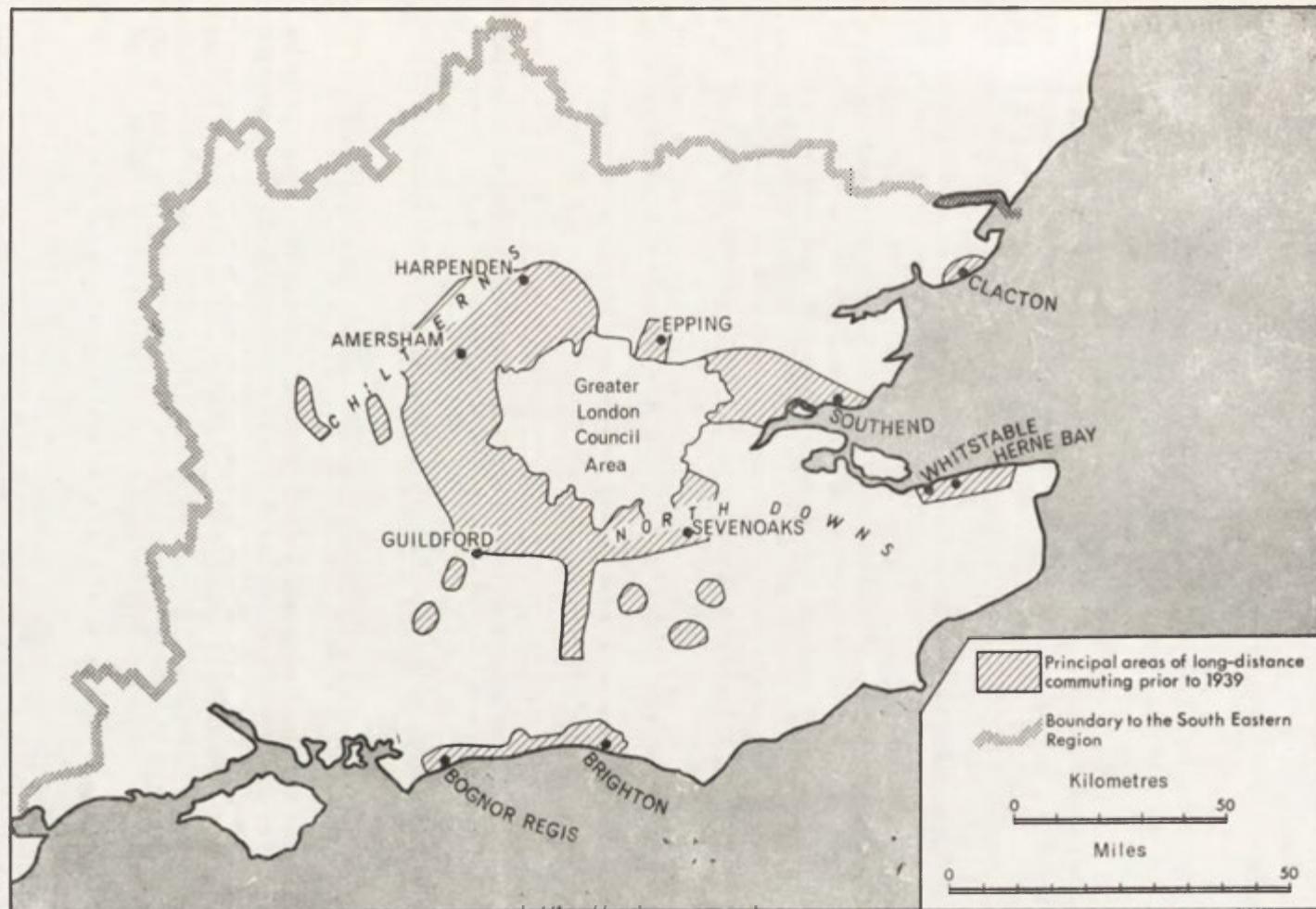


Fig. 4. Principal areas of long-distance commuting prior to 1939

After the war growth in many of these was limited by the Green Belt policy. Elsewhere growth depends on the policies of the particular Planning Authority. Extensions of existing towns were allowed almost everywhere, but particularly in coastal towns, while small speculative estates were allowed in many villages.

This led to increases in the adventitious population in virtually every rural village. Much of this adventitious population is employed in nearby towns, but in many villages Central London commuters form an important element. Thus prior to the War few long-distance commuters originated in N. Kent from stations between Chatham and Whitstable. Since 1959, however, there has been a great increase in commuting from those intermediate stations, especially from Rainham. Unfortunately such scale of growth was not envisaged at the time when the modernisation of this line was planned and it has proved difficult to provide extra peak-hour capacity to meet this demand. Again, prior to 1955 long-distance commuting was virtually unknown from the area north of the Chiltern Hills. But since then there has been a great improvement in the train services. Electrification in 1966 brought such an influx of commuters into the villages between Tring and Northampton, that 5 extra peak hour trains were put on in 1970. The fast diesel service from St. Pancras has also led to growth in the area between Luton and Bedford, and even beyond.

There is some evidence from E. Kent that the provision of drainage may be a limiting factor. A student field class from Salford in 1970 found that construction of new houses had ceased in villages around Canterbury and had virtually ceased around Whitstable. While it is true that economic conditions could partly explain this reduction in activity, it was the capacity of the drainage system that had led to widespread refusals of building applications by the Planning Authorities.

#### MOTIVATION

Work on the motivation of long-distance commuters has been very limited. Smith<sup>11</sup> has published work on the Ashford (Kent) area and one of the present authors, G.D.S. Goddard,<sup>12</sup> has studied conditions in the area between Whitstable and Ramsgate. The results tend to show that long-distance commuters are of three major types.

#### (I) COMMUTERS IN HIGHER-INCOME GROUPS

These travel long distances in order to live in what they consider to be a better environment. They are aided in this by the availability of picturesque country houses and cottages for modernisation. This is because farming in many of these areas was never of a high quality and there were no surplus profits in the 19th century for rebuilding the houses. Present prices of such houses are very high. These commuters travel long distances from preference, and for them journey-time is of more importance than cost of journey or of housing.

<sup>11</sup> *Ibid.*

<sup>12</sup> G. D. S. Goddard, *The outward growth of commuting in the London Region with special reference to North-east Kent*. Unpublished dissertation for the Degree of M.Sc. in Urban Studies (University of Salford, 1969).

## (II) COMMUTERS IN LOWER-INCOME GROUPS

These are particularly younger commuters attracted by the lower cost of small, new houses in the more distant areas. Although this saving is balanced by increased travel costs, the deposit needed for obtaining a mortgage is lower, and newly-married couples are often unable to find the large sum necessary to buy a house in Greater London. These commuters travel long distances because they have to if they wish to own a home of their own.

## (III) COMMUTERS NEARING RETIREMENT

This group is to be found particularly in the seaside towns. They have formerly lived in Greater London but as their retirement approaches they have bought smaller houses in a more pleasant environment and commute until they retire.

It may also be possible to distinguish a fourth class. The unmarried children of people living in the OMA or beyond may have jobs in London and may prefer to be long-distance commuters until they marry and live in Greater London. It is probably cheaper for them to live at home and pay high rail fares than to obtain expensive flat accommodation in the inner suburban zones.

Little work has been done to quantify the numbers and distribution of the four groups. But a survey of commuters from the South Midlands (Table 2) made a distinction possible. Of the respondents from Area C, 74% of the season-ticket holders were commuters by our definition. The majority lived in expensive residential areas and were of Group (i). Of the respondents from Area B, 96 per cent were commuters. They were younger and lived in inexpensive post-war estates, and were of Group (ii).

Nor has any work been done on the origin of the long-distance commuters. There is some reason to believe that as the commuter's income increases he tends to move out further from London but within the same sector as his previous home. Thus a person living in North West Kent would tend to move to Mid-Kent or East Kent, whereas someone living in East London would tend to move towards Southend or Clacton. A person may prefer to live where he can travel into a railway terminus adjoining his work. Some support, however, is given to these propositions by Leigh's statistical examination of the spatial characteristics of the journey to work in Greater London.<sup>13</sup>

## A STUDY OF NORTH EAST KENT

We shall now turn to a more detailed examination of the journey to work from the coastal towns of North-East Kent, located between 57 and 77 miles (92 and 125 km) from the City of London (Cannon Street Station) (Fig. 5A). Modernisation of the railways in this area in 1959 resulted in considerable growth in commuting to London from a region with traditional commuting links and which offered a limited range of local employment.

### TRAIN SERVICES

In 1948 the Kentish lines of the newly nationalised British Railways fell into two distinct groups; (i) the electrified suburban system, with intensive services extending across the Green Belt to Sevenoaks, Maidstone and Chat-

<sup>13</sup> T. Leigh, *The journey to work in Central London, 1921-51*. Unpublished thesis for the Degree of Ph.D. (University of London, 1968).

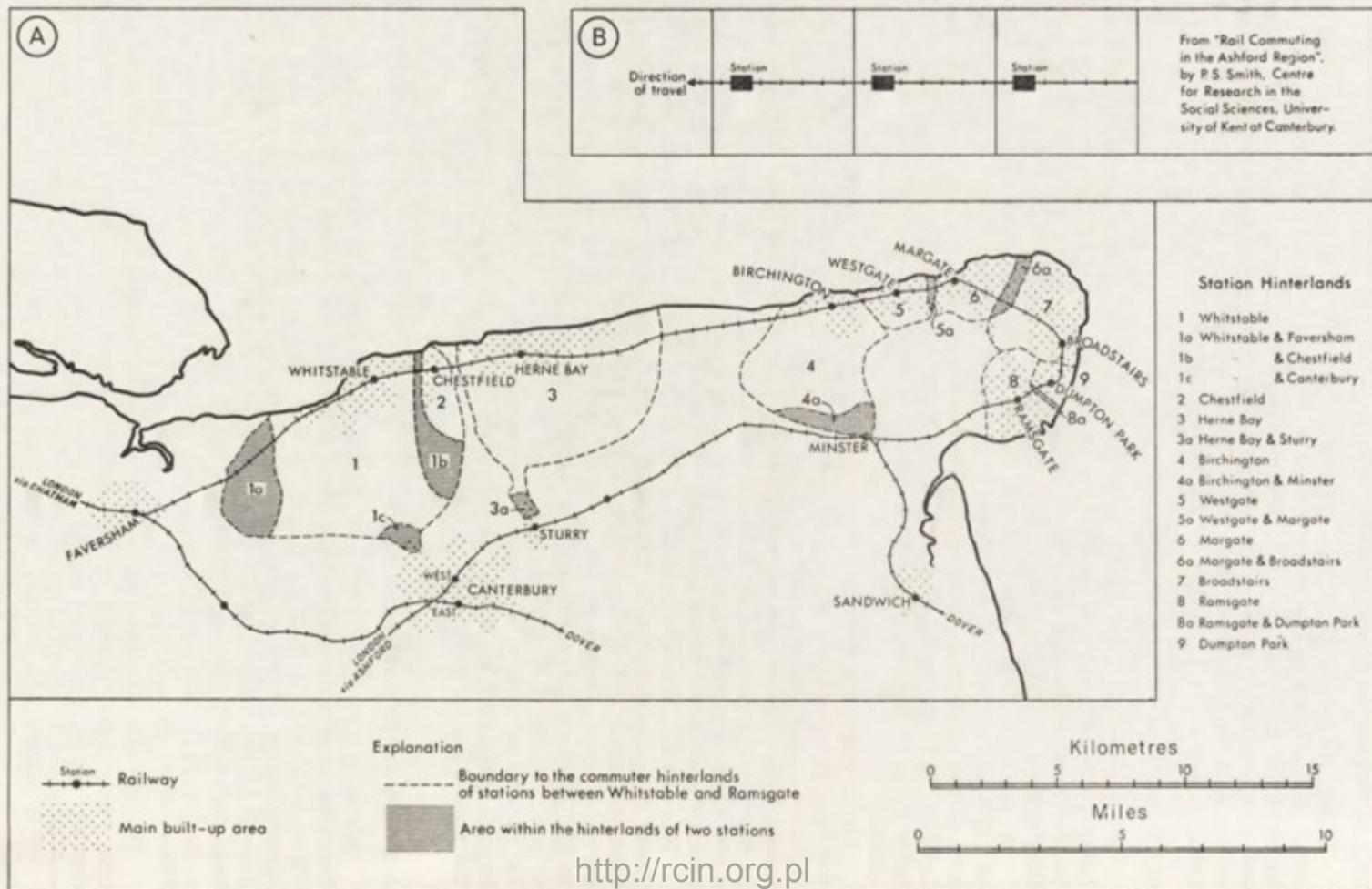


Fig. 5. (A) The terms of North-east Kent rail routes and station hinterlands (B) Idealized station hinterlands

ham; (ii) the steam-worked lines beyond, which during the 1950s became increasingly important with the extension of London's commuter hinterland. These latter linked London with East Kent by three main lines, which conform to the physical structure. The line *via* Chatham follows the northern edge of the North Downs dip slope. The line to Ashford via Maidstone follows the narrow vale of Holmsdale, while that *via* Tonbridge runs through the wide Vale of Kent.

As a result of intensive rivalry between two railway companies between 1860 and 1900, there is considerable duplication of routes<sup>14</sup>, which means that the towns of East Kent are particularly well served by lines to London; usually each town has a choice of routes. In addition to the growing commuter traffic, the lines also carry a heavy holiday traffic to the Kent Coast resorts, while Cross-Channel traffic also becomes increasingly important.

The steam services were working to a timetable basically unaltered since 1926, apart from extra trains and from increased seating capacity of the principal trains. In 1955 it was therefore decided to electrify the lines to East Kent. This would also mean that the elimination of steam and the universal use of electric multiple-unit trains<sup>15</sup> would increase the capacity of the London termini and allow more peak-hour trains.

Electric operation of the lines to Ramsgate and Dover *via* Chatham began in 1959. In 1962 conversion of the lines *via* Ashford was completed. Faster trains and improved track layout and signalling allow greatly increased capacity on commuter services from East Kent. Further intensification of services took place in July 1967, when a completely new timetable was introduced, following three years of survey work on travel habits throughout the Region.<sup>16</sup>

The coastal towns of North East Kent fall into two distinct groups. Lying furthest from London are the "Isle of Thanet" group of Margate (population 48,470), Broadstairs (18,810) and Ramsgate (39,080) (a total of 106,360). To the west, separated from Thanet by the Wantsum marshes, is Herne Bay (24,350), which virtually joins on to Whitstable (21,950) (a total of 46,300). All these towns are important holiday resorts which grew rapidly after the arrival of the railway in the mid-nineteenth century.

Since the Second World War a significant proportion of residential development in both these groups of towns and in the adjacent rural districts has resulted from the growth of long-distance commuting. Some indication of this growth can be obtained from Table 3. Although these figures may be subject to some error owing to the fact that the 1961 and 1966 information was collected from a 10% sample of population, they do clearly indicate a rapid increase in the growth of commuting during the 1961-1966 period. This can be readily understood when the improvements in speed and frequency of peak-period train services are considered (Table 4).

<sup>14</sup> For fuller details see: H. P. White, *A regional history of the Railways of Great Britain, vol. 2: Southern England* (Newton Abbot, 1969—3rd edit.), Chap. 3.

<sup>15</sup> "Multiple-unit" trains are made up of one or more self-propelled units of two or more cars, each unit being capable of being driven from either end. Advantages for suburban service are (a) ease of increasing and reducing train length to match diurnal variation in traffic, (b) increase in power in proportion to train length and (c) time saved in attaching and detaching locomotives at terminals.

<sup>16</sup> British Railways Board, Southern Region, *Passenger Survey, 1964* (unpublished). Our grateful thanks are due to the staff of the South Eastern Division of the Southern Region, Beckenham, for allowing access to this survey.

It will be seen that electrification allowed the doubling of seating capacity on peak-period trains. But the superiority of the electric train is also shown in the improved timing of the services, especially where stops are numerous. While the fastest time from Whitstable to London was cut by only 4 minutes, the fastest Ramsgate-London trains had their journey time reduced by 15 minutes. Nevertheless, after 1959 the journey times from Whitstable to Margate and Ramsgate were about 20 and 30 minutes respectively. While a number

TABLE 3. Local authority areas in East Kent — residents working in the London conurbation

	A Residents employed in the London Conurbation	B Column A expressed as % of the total no. of employed residents
Ramsgate		
1951	153	1.2
1961	170	1.1
1966	210	1.4
Broadstairs		
1951	181	3.6
1961	350	5.7
1966	310	4.8
Margate		
1951	500	3.1
1961	840	4.8
1966	940	5.1
Herne Bay		
1951	367	6.0
1961	670	9.5
1966	1,040	12.8
Whitstable		
1951	506	8.6
1961	920	13.2
1966	1,220	14.7

Source: Census of England and Wales, 1951, 1961, 1966 (sample): Workplace and Transport Tables (London, H.M.S.O.)

of business trains from Whitstable run non-stop to Cannon Street, the journey from Thanet includes a comparatively slow stopping section as far as Whitstable. The latter town could now be reached in 75 minutes, a journey time which compares favourably with times from considerable parts of the outer suburban area. However journeys to Thanet taking over 90 minutes proved less encouraging to commuters.

This is substantiated by the figures in Table 3, which indicate a greater commuter growth rate in Whitstable and Herne Bay than in Thanet. Further evidence of this comes from the Southern Region 1964 passenger enquiry reports, based on a questionnaire to all railway travellers in the region on a Spring day in 1964.<sup>17</sup> Between 06.00 and 09.00 hours 1,584 persons left Whit-

<sup>17</sup> *Ibid.*

stable and Herne Bay for Central London, while 1,012 left the Thanet towns. Of the latter figure, only 133 (7% of the total) persons travelled from the two stations in Ramsgate, reflecting the 2 hour journey time to London.

TABLE 4. Train services from N. E. Kent to London via Chatham

	A Post-1959 Steam	B Post-1959 Electric	C Post-1967 Electric
<u>Morning Business Trains</u>			
Total	6	9	12
To "City" (Cannon Street)	6	5	7
To "West End" (Victoria)	—	4	5
Average time from Ramsgate	2 hr 10 min	1 hr 59 min	1 hr 55 min
"    "    "    Whitstable	1 hr 24 min	1 hr 22 min	1 hr 21 min
Fastest time from Ramsgate	1 hr 59 min	1 hr 44 min	1 hr 43 min
"    "    "    Whitstable	1 hr 14 min	1 hr 10 min	1 hr 9 min
<u>Evening Business Trains</u>			
Total	6	7	10
From "City" (Cannon Street)	6	5	6
From "West End" (Victoria)	—	2	5
Total peak seating capacity to N. E. Kent	2,412	4,916	7,345

Source: British Rail, Southern Region, public and working time-tables

#### STATION HINTERLANDS

In order to ascertain the extent of the area around each station from which commuters are drawn, the Station Managers were asked to delimit the hinterlands of their stations, based on addresses of season-ticket holders. Figure 5A shows that hinterlands in several cases extend well beyond the Local Authority boundaries.

Normally one might expect station hinterlands to be elongated in the direction opposite to the travel direction, as shown in Fig. 5B. Commuters are unwilling to travel away from their ultimate destination in order to reach a station. But this is clearly not the case in the Whitstable-Herne Bay area. The catchment area for Whitstable extends several miles towards Faversham, the next station, which is 7 miles (11.3 km) away. The fact that a number of business trains from North-east Kent do not call at Faversham and in some cases run non-stop from Whitstable to London appears to encourage people in the Faversham Station hinterland to travel back to Whitstable to catch a faster train. The 8 miles between Birchington and Herne Bay Stations is the reason for the extension of Birchington's hinterland to the eastern extremity of the Isle of Thanet, beyond which there is little settlement.

The fast and frequent business service on the North-east Kent line is reflected in the southward extension of several of those catchment areas. Those of Whitstable and Herne Bay reach the edge of both Canterbury, which is served by the Ramsgate-Ashford-London line and the Dover-Faversham line, and Sturry, on the former line. As London business trains take longer

on these routes, some commuters prefer to drive about 5 miles (8 km) to the better-served stations at Herne Bay and Whitstable. Similarly a number of commuters from Minster, on the Ramsgate–Ashford–London line, prefer to travel from Birchington Station. Thus it is found that the idealised station hinterlands are considerably modified by the characteristics of the train service provided and by the pattern of main roads focusing on the stations.

#### TRAVEL TO STATIONS

The station hinterlands cover largely rural areas. The car therefore forms the main mode of transport to the station. Some commuters use local buses if they live in towns, although they are not generally favoured by long-distance commuters because their use increases the time spent on a very small proportion of the journey.

The size of the station hinterlands is reflected by car parking. Whitstable and Herne Bay stations both have large car parks, holding about 100 cars. The Station Manager at Whitstable estimated daily users to be 90–100 cars, which was confirmed by a spot-check which found 88 cars in the car park on a Summer working day and 18 in nearby streets. Birchington, also with a large catchment area, generally has about 40 cars parked at or near the Station. The other Thanet stations have only small numbers, probably because of their smaller catchment areas and the availability of bus services. The small stations at Chestfield and Westgate are without station car parks and most of their commuters live within walking distance.

The Station Managers agree, however, that a considerable proportion of their commuters were driven to the station by their wives, who were then able to use the car during the day. This practice of “kiss-and-ride” probably becomes less significant as distance from home to station increases. Though no work has been done on the subject, it might be interesting to investigate the relationship between the distance from home to station and the willingness of wives to take their husbands regularly to and from the train.

#### HOUSE PRICES

Commuter growth in the outer parts of the London Region has naturally been accompanied by a high rate of house building. The number of new houses completed in the suburban areas of Kent rose steadily each year from 1950 to 1966. But in East Kent new construction remained at a fairly low level until 1959, when it began to rise, reaching a peak in the year 1963 to 1965. As mentioned earlier, housing in these outer areas attracts commuters in the lower-income groups because prices are lower than in the suburban zone. A study of property values in East Kent for the period between 1950 and 1966 showed that, although prices rose steeply during the late 1950s and the 1960s, following the national trend, they remained considerably lower than prices near London. Throughout the period a 3-bedroomed house in Bexley, about 15 miles (25 km) from Central London, cost £1000 to £1500 more than an equivalent house in Herne Bay and Thanet respectively. Mortgage deposits would therefore be considerably lower in East Kent. However the combined cost of commuting and the monthly mortgage repayment for East Kent would certainly equal, and would probably be more than, that for a suburban house nearer to London. Thus, in order to take advantage of lower initial housing costs, the East Kent commuter pays the penalty of high monthly costs, combined with a long journey to work.

In contrast, there are a number of commuters using North-east Kent services who fall into the higher-income group. The rural districts to the south of Whitstable and Herne Bay contain a number of picturesque villages, while old farm houses and cottages have been renovated to provide rural homes. Unlike new homes in the towns these dwellings are more expensive than their suburban counterparts, the rural environment having an important effect on their values.

Persons nearing retirement form a significant proportion of the long-distance commuters from our area. Considerable numbers of bungalows for such people were built in this area following the electrification. From the railway view this meant that the initial heavy demand for London commuter-services could fall off after a few years as these people began to retire. However, this has proved less of a problem than anticipated because the general demand for commuting from East Kent has been far greater than was expected in 1959. The main problem of the retiring commuters however is their effect of unbalancing the age-structure, thus creating the need for heavy expenditure on health and social services for old people. Recently some of the Local Authorities in the area have used their planning powers to reduce the rate of construction of new bungalows.

#### THE FUTURE

The wide variety of factors influencing commuting make predictions of future growth difficult. As mentioned above, the growth of long-distance commuting from East Kent during the early 1960s was on a considerably larger scale than was anticipated by British Railways at the time of modernisation.

A comparison of columns B and C of Table 4 shows the additional capacity found necessary on the North-east Kent line after the passenger survey of 1964. The post-1967 timetables provide three times the number of seats between London and North-east Kent than the pre-1959 steam-operated services. This present timetable means that, during the peak periods, the South-Eastern Division is working at maximum intensity. In addition to the traditional points of congestion on the inner approaches to the London termini, several new bottlenecks have developed as a result of the increase in the number of long-distance peak services.

Other factors besides rail capacity can also affect commuter growth. At present work is underway to improve to Motorway standard the suburban sections of the A2 road from North-east Kent to London. Within a year or two these areas, at present beyond car commuting range, will be within 1-1½ hours' drive of the inner suburbs. This may encourage long-distance commuters to use their cars for the major part of their journeys, parking in the inner suburbs and only using public transport for the last few miles into Central London.

Planning policy is another major influencing factor on future commuting levels. We have already mentioned the present restrictions on building in the Whitstable/Herne Bay area, resulting from overloading of local drainage systems. However, in the long term North Kent has been suggested as a suitable sector for growth in the Southern Region by the South East Economic Planning Council in 1967<sup>18</sup>. If this pattern of growth is accepted it is possible that

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<sup>18</sup> South East Economic Planning Council, *A strategy for the South-East* (London, H.M.S.O., 1967).

commuting from this region will increase considerably, and capital may be invested to increase the capacity of rail links to London.

Finally, account must be taken of future trends in office employment in Central London. The Southern Region statistics show that overall commuting figure stopped rising in the later 1960s. Though long-range commuting is still developing, it has been balanced by a slight decline in commuting from the suburban zone. It is also significant that this period has seen the beginning of the widespread use of computers. In future, much of the routine clerical work of offices may quite possibly be taken over by electronic machines, eliminating the need for a significant proportion of the present Central London workers. It would therefore seem unwise to invest heavily in providing extra capacity on peak-period rail services until it is clearly understood to what extent the computer will be replacing the commuter.

University of Salford

# THE SOCIAL AND ECONOMIC INTERACTION OF URBAN AND RURAL LAND-USES ON THE WESTERN PERIPHERY OF EDINBURGH

ALAN J. STRACHAN

## INTRODUCTION

Throughout history cities have been surrounded by a zone of varying dimensions within which the intensity of urbanisation tends to decrease with distance out from the city, while rural land-uses correspondingly increase. Apart possibly from the medieval period, when the city wall acted as an artificial restraint, city growth has progressed unhindered within the limitations imposed by such factors as physical features, transport potential and building technology, to name but a few. In Great Britain this element of

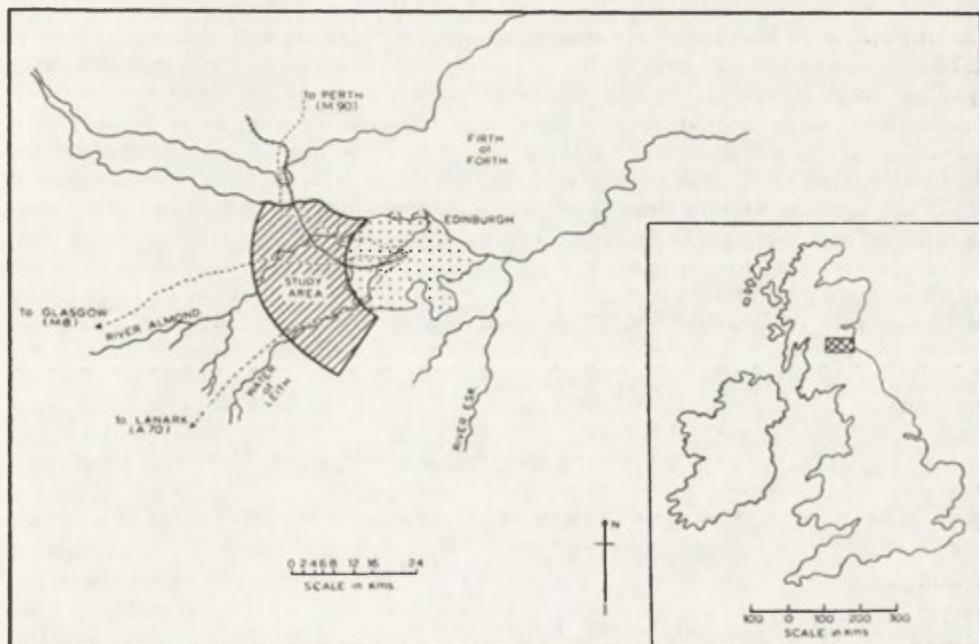


Fig. 1. The location of Edinburgh

<http://rcin.org.pl>

freedom was effectively ended with the passing of the Town and Country Planning Act, in 1947. Under this Act all local authorities were to prepare a Development Plan of the area under their control; this work was to be a two-part document, comprising a volume of maps and one of text, that would outline the actual and proposed use to which every parcel of land would be put. In this way it was hoped to rationalise land use in order to make the most efficient use of the limited land resources of the United Kingdom. In an attempt to evaluate the effects of twenty years of planning control a study was made of the social and economic interaction that has developed between Edinburgh and the surrounding rural area.

## THE STUDY AREA

The area studied is bounded by the Firth of Forth to the north (Fig. 1) and the Pentland Hills to the south and is an undulating lowland of very productive agricultural land. The settlement pattern that developed over the centuries was one of numerous isolated farms, with a close network of villages which fulfilled the dual function of rural service centres and minor industrial foci.

## THE EFFECTIVENESS OF PLANNING CONTROL

Over the years those villages in close proximity to Edinburgh received an influx of city people and, as tentacles of urban growth spread outwards, many were absorbed, until by 1939 the built-up area had assumed the star-shaped form typical of most British cities at that time. Growing alarm at the inefficiency and wastefulness of this form of urban expansion, in terms of both the provision of services to a dispersed city population and the disruption to farming caused by the indiscriminate sale of roadside-land for house building, was one of the main reasons for the introduction of planning legislation in 1947.

The effectiveness of the restraints imposed on the subsequent development of the City of Edinburgh is clearly illustrated in Fig. 2 which depicts the distribution of land-uses to the west of the city in 1967. The compactness of the built-up area at this time is all the more remarkable because of the considerable affluence and widespread car-ownership typical of the present day. Four major roads continue to form fingers of urban expansion, but these are much more substantial developments than were to be found on the periphery of the city before planning controls were introduced. The residential estates at Cramond, on the shores of the Firth of Forth, form the only discontinuous housing developments within Edinburgh's administrative area. The containment of the city's growth was one of the policies advocated in its Development Plan, with the aim of creating an effective urban pattern that would cause the least disruption to the economy of the surrounding agricultural area. The Plan indicated that this was to be achieved by guiding residential expansion into the wedges of open space that penetrated into the urban area in 1947 and to allow only a very limited amount of infilling and growth to take place elsewhere around the city. These proposals were very strictly adhered to throughout the early 1950's despite the increasing pressure from private house-building contractors to have these restrictions waived, in order that the growing demand for houses could be met. However, instead of yielding to these requests the City Planning Authority, in response to growing pressure from the Minister

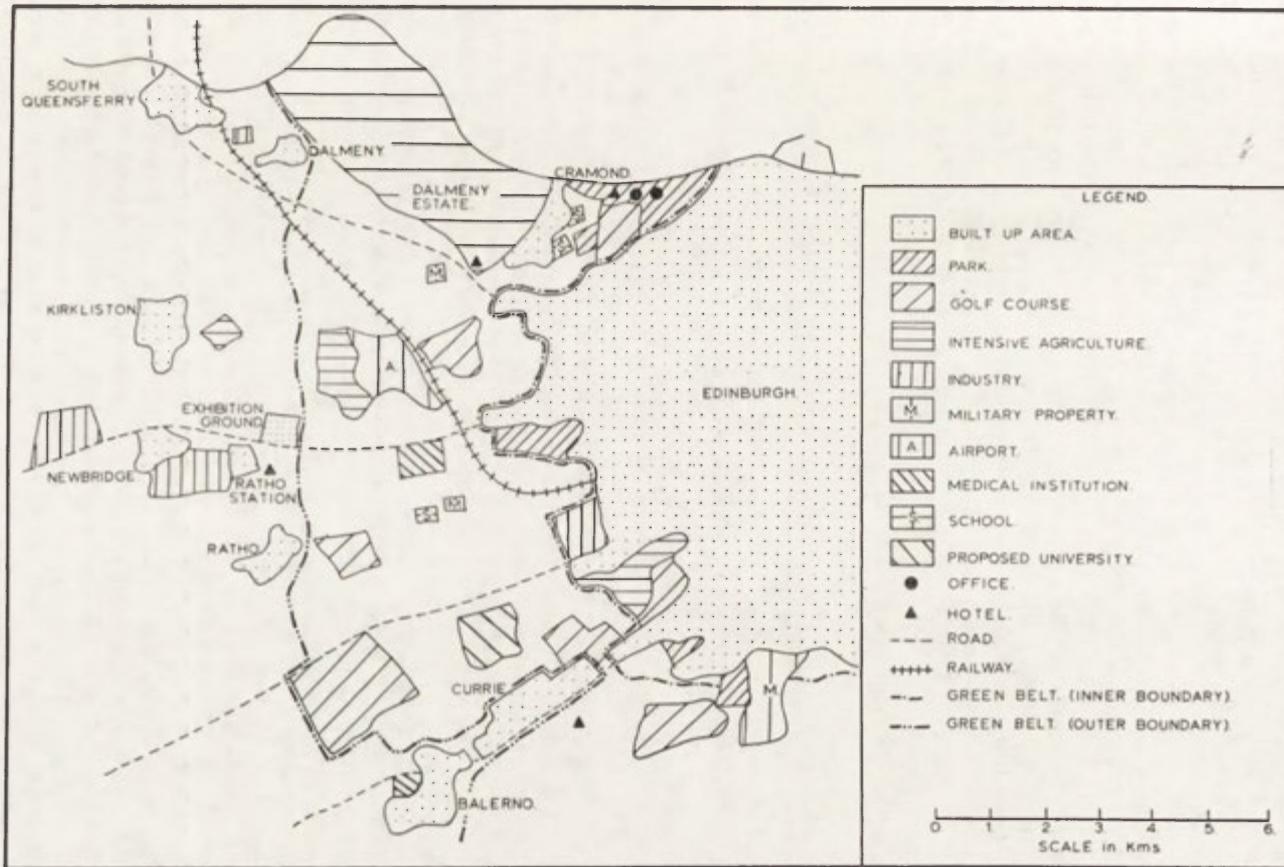


Fig. 2. Location of land uses on the western periphery of Edinburgh in 1967

of Housing and Local Government<sup>1</sup> met with the Planning Departments of the three adjacent County Councils of East Lothian, Midlothian and West Lothian to consider the establishment of a Green Belt around the city. Agreement was reached in 1956 and a zone of permanent open space, within which all future building was to be strictly controlled,<sup>2</sup> was created. The inner boundary of this area re-emphasised the city's policy of containment, being located very close to the existing built-up area. The fact that this barrier to urban expansion would necessitate the provision of out-of-town residential estates was fully appreciated by the local authorities, for the outer boundary of the Green Belt was drawn in such a way as to exclude the neighbouring villages where many of the services that would be required by this overspill population were already in existence. This studied manipulation of the outer boundary is most clearly displayed with regard to the village of Currie, to the south-west of Edinburgh, where the width of the Green Belt was reduced from an average of between 2 miles (3.2 km) and 3 miles (4.8 km) to a mere 110 yards (100 m) in order that the previously designed expansion of the community could take place as planned.

#### FACTORS INFLUENCING THE LOCATION OF LAND-USES IN FRINGE AREAS

These planning policies have created an easily-definable built-up area around which there is a concentration of recreational facilities, with agricultural land beyond these. In addition, increasing leisure time, improving transport media, and cheap land, compared with city-centre land values, have attracted many urban-orientated functions out to peripheral areas. Mansion houses with extensive grounds, as well as agricultural land, have come under quite considerable pressure from city-based institutions and sports clubs. Many of the former have been converted into hotels and administrative centres, with their enclosed grounds ensuring the privacy such activities often seek. As a result there has been diffusion into the rural area of a considerable number of activities all of which are to some extent dependent on the proximity of Edinburgh, with its important administrative, financial, medical, educational and capital-city functions. Offices, hotels, military establishments, hospitals, schools, university, golf clubs and the agricultural show ground have all found these houses to be an excellent way of securing a peripheral site, despite Green Belt controls.

Notwithstanding the high level of personal mobility enjoyed by an increasing proportion of the population, closeness to the built-up area continues to be an important factor in the location of many activities, especially those that depend upon daily access by large numbers of people. This has given rise to a zone, immediately beyond the urban area, within which neighbourhood parks, playing fields, three "mansion-house" offices and several long-established golf courses, along with a few other urban-orientated land uses, are to be found. Beyond this girdle of intensive urbanisation the remainder of the Green Belt contains a much lower, but still significant, concentration of activities dependent upon the city. At Gogar a large mental hospital has come to occupy several adjacent mansion houses. A neighbouring large house is now a school

<sup>1</sup> Ministry of Housing and Local Government, *Green Belts*, Circular No. 42/55 (H.M.S.O., 1955).

<sup>2</sup> Ministry of Housing and Local Government, *Green Belts*, Circular No. 50/57 (H.M.S.O., 1957).

for physically-handicapped children, an establishment requiring ample space away from busy roads, yet needing to be close to the medical facilities in Edinburgh. A children's home and convalescent home have been established in large houses to the south-west of the city, in both instances attracted by the quietness, fresh air and other amenities afforded by the rural surroundings.

As the capital of Scotland Edinburgh has a greater diversity of military establishments than would normally be associated with a city of its size. The 1914 and 1939 wars led to an expansion of facilities close to the city. This took the form of a barracks on the flanks of the Pentland Hills and an airfield at Turnhouse, where extensive tracts of suitable land were available. After the war the Air Force continued to control the airport, but it was increasingly used for commercial purposes and in 1966 was finally handed over to civilian control; only a small military detachment remained on the base. The command headquarters for the Scottish Armed Forces are understandably centred on Edinburgh, but because of a shortage of space and antiquated facilities within the city, a new headquarters was established in 1951 in Craigiehall House, which was converted for the purpose, and another command centre was set up in Gogarbank House. Both of these establishments are in peripheral locations, but have easy access to the city's other military facilities, the government offices in Edinburgh and the airport.

The rapid increase in the number of tourists visiting Edinburgh in recent years has created a demand for accommodation which the hotels within the city have been unable to meet. Several large mansion houses within a few kilometres of the city centre have been bought and converted into hotels to take advantage of this situation. These establishments not only cater for the influx of summer visitors, but maintain their business throughout the year by providing excellent restaurant facilities and organising dinner-dances to attract city people.

Prior to 1958 the Royal Highland and Agricultural Society's annual show moved from city to city throughout Scotland, but increasing expense and low public attendance in the more remote centres led the organisation into financial difficulties. In an attempt to remedy this situation, Ingliston golf course was bought in 1958. This location had excellent road, rail and air transport facilities and its nearness to Edinburgh, with its hotel accommodation and large population, was an added attraction. The show lasts only four days, but the society has so designed the internal road network that the grounds can be used as a motor-car racing, motorcycle racing and karting track throughout the remainder of the year.

Increased urban-rural interaction will also result from the re-location of the Heriot-Watt University. The university's city-centre site could not cope with the expansion of facilities necessary to house the annually-rising number of students. In order to prevent fragmentation the university's administrators decided to purchase the Riccarton Estate on the west side of the city. The development of the new campus has not yet begun and although it is proposed to provide both teaching facilities and student residences at Riccarton the wide variety of social and entertainment facilities available in Edinburgh will give rise to intensive interaction between the two centres.

Edinburgh is not a major industrial centre. Those industries that have located there have tended to concentrate in the heart of the city, intermingled with nineteenth-century housing developments and have never constituted important peripheral land-uses. However, during the interwar period several road-side factories were established beyond the built-up area, but urban growth

has now reached out and encompassed them. The demand for factory space grew in the immediate post-war period and in 1947 the City Corporation established an estate at Sighthill, a peripheral site which had the advantage of the relative cheapness of rural land. This estate has now been fully developed. Recent government policy, however, has placed the city at a distinct disadvantage with regard to the attraction of new industries, since it was the only part of Scotland not to be given Development Area status. Under this scheme the government provides financial incentives to industrialists locating new factories in the older industrial regions and other regions of inadequate industrial employment. Exclusion from this scheme has meant that new industries moving into the region and firms already located in Edinburgh, but wishing to expand, find it to their advantage to build factories on the industrial estates established close to the city by the neighbouring local authorities, two of which (Midlothian and West Lothian) are to be found in the study area. The proximity of Edinburgh was obviously of considerable importance to most of the firms on these industrial estates, although, when interviewed, the managers emphasised that the main attraction of the Lothians was the availability of a plentiful supply of labour and good sites, rather than closeness to Edinburgh. Despite these assertions, however, the managers did agree that the financial and other central services available in the city were of considerable importance, as was the availability in Edinburgh of houses for the managerial and administrative staffs. The closeness to Edinburgh of these new industrial estates has also meant that many of the people working for firms that have moved out from the city have not had to change their place of residence, but commute daily out to the new factory.

### AGRICULTURE ON THE URBAN PERIPHERY

Agricultural land constitutes by far the greatest proportion of the Green Belt area and so it is appropriate that the relationship between this activity and the adjacent city should be examined. Studies carried out in North America<sup>3</sup> have emphasised both the disruptive influence of urban expansion on the economics of the adjacent farms and the specialisation of production on these farms to meet the needs of the nearby city market. With this in mind, a survey of the farms around Edinburgh was undertaken; this showed that apart from those concerns bordering upon local authority housing areas, where, in order to minimise damage to fences and ditches, theft of crops and animal worrying, unsatisfactory crop rotations had to be adopted, the proximity of the urban area had little effect on farm activities. The urban market was also found to be of little significance in determining crop specialisation on these farms, since, as was pointed out by several farmers, distances in the United Kingdom are so small that there is no clear price advantage to be gained by sending all produce to the nearest city; consequently, apart from three dairy farmers who did find proximity to the urban market to their advantage, the farm economies in this area tended to correspond to a regional rather than a local pattern. However, market gardens, especially those of less than twenty acres (eight ha) located within 6 miles (9.6 km) of the city centre, depend quite heavily on the

<sup>3</sup> E. Higbee, *The squeeze: cities without space*, 1961, p. 159; M. Young, Some geographical features of the urban fringe, *The Southeastern Geographer*, 2(1962), 1-7; J. Gottmann, *Megalopolis: or the urbanization of the north eastern seaboard of the United States*, 1961, Chap. 6.

nearly urban market. There are in fact very few of these gardens on the western side of the city. The main concentration lies to the east of Edinburgh on the sandy soils of the raised beaches along the coast and on the rich alluvial soils of the Esk Basin: in the western district the coastal area, with its raised beaches which might otherwise have been expected to develop into a market-garden area, lies entirely within the private Dalmeny Estate. The latter, owned by Lord Rosebery, illustrates the way in which a wealthy landowner can reduce the interaction between a city and its adjacent rural area to a minimum.

Smallholdings, i.e., agricultural units of between two and four hectares in size, have intimate relationships with the city. Their small size necessitates specialisation in those forms of production that bring in a high return per unit area, with the result that market gardening, nursery gardening, poultry, pig- and dairy-cattle keeping tend to be the main activities followed. These products find a ready market in the urban area and to take advantage of this outlet two groups of holdings were located to the west of Edinburgh.

### THE EMERGENCE OF DORMITORY SETTLEMENTS

As already indicated, the aim of the Green Belt policy was to surround a city with an open space within which urban recreation facilities and institutions in extensive grounds could be located and where agriculture could continue to play an important role;<sup>4</sup> it was to be a "lung" to allow a city to breathe. In Edinburgh's case this belt encompasses all of the land-uses that are overwhelmingly dependent on the city. This does not mean that Edinburgh people do not patronise facilities located beyond this area, for the whole of Central Scotland is easily accessible to them, but the Green Belt is the zone of intensive interaction between the city and its surrounding rural area.

The exceptions to this statement are features of urban-rural interchange that have become increasingly important over the past decade. These are the residential links that have developed between Edinburgh and the neighbouring villages, with the decline in rural employment opportunities and the outward movement of city workers unable to find suitable houses in the urban area. It was not until the late 1950's that the influx of people into the adjacent rural area reached major proportions, a situation that was brought about by post-war planning policies. As has already been stated, very little land within the city was allocated for house building purposes, especially for the private sector. This forced firms to look beyond the Green Belt for new housing sites when land within Edinburgh became scarce; and this overspill development was guided by the neighbouring local authorities into the villages which lay immediately beyond the controlled area. Having been forced to consider out-of-town locations, private contractors turned their attention to those villages that would be most attractive to commuter families, that is those with high amenity value, a comprehensive range of facilities and services already in existence, and good road access into the city. The villages of Currie and Balerno fulfilled these requirements most adequately and as a result have been the main recipients of new private housing estates.

Midlothian and West Lothian County Councils have also been faced with a considerable problem with regard to the provision of local authority housing. These houses are specifically for people already living in the local authority area or for those working there. At first such housing estates were located

<sup>4</sup> Ministry of Housing and Local Government, *The Green Belts* (H.M.S.O., 1962).

almost indiscriminately in the towns and villages where demand was greatest with little regard to the availability of employment. During the late 1930's, however, the job potential of the district was increasingly taken into account. In the area to the west of Edinburgh, with the decline in the agricultural labour force and the running down of the oil-shale industry, the unemployment situation became increasingly grave and the city emerged as the only alternative place of work for many of the people. The county councils were quick to realise this and sited their housing developments as close as possible to the city in Currie, Balerno, Ratho, Newbridge, Kirkliston, Dalmeny and South Queensferry: with the exception of Newbridge and Dalmeny additional houses have been built in these settlements during the post-war period.

#### SOCIO-ECONOMIC CHARACTER OF THE DORMITORY SETTLEMENTS

It was therefore necessary as part of an investigation of the urban-rural interaction around Edinburgh to make a study of the adjacent communities. The only source of information on social and economic interaction is the Census of Scotland,<sup>5</sup> but unfortunately this provides statistical data only for the relatively large units of "Large Burghs", "Small Burghs" and "Districts" of each county: this greatly reduces the usefulness of the data for a detailed settlement study.

South Queensferry is the only settlement in the study area for which specific census data were available; it will therefore be considered on its own. As the lowest point at which a ferry across the Forth could be operated easily, South Queensferry emerged as a transport focus at a very early date; it also came to act as a local area shopping centre, with a few service activities but very little industry. Fluctuations in the strategic importance of the nearby naval establishments have had a considerable effect on the growth of the burgh. During the inter-war period quite a large number of local authority houses were built in the town, drawing in people from the surrounding districts, but this was done without a commensurate increase in the local employment potential, with the result that many people with homes in the burgh had to look elsewhere for work, and because of the almost total absence of local industry commuting into Edinburgh became increasingly important. By 1951 some twenty nine percent of South Queensferry's labourforce worked in the city;<sup>6</sup> this had fallen slightly by 1961,<sup>7</sup> but had risen to thirty percent by 1966<sup>8</sup> (Table 1). The shortage of employment in the town has meant that over forty percent of the female labour-force work in Edinburgh, but whereas this has been declining in recent years the proportion of male commuters has increased. This changing situation has been brought about mainly as a result of the opening of the Forth Road Bridge in 1964 and the location of a new electronics factory, attracted to Scotland by the Development Area incentive scheme, on the outskirts of the town in 1966. One of the attractions of the area was the promise of ninety local authority houses for the key workers who were to move north with the firm and, as a result, although the factory now employs 410 people, its impact on the employment situation in the burgh has not been

<sup>5</sup> *Census of Scotland, 1961, Workplace Tables, Table I.*

<sup>6</sup> *Census of Scotland, 1951, Vol. 4, Table 15.*

<sup>7</sup> *Census of Scotland, 1961, op. cit.*

<sup>8</sup> *Census of Scotland, Sample Census, 1966, Workplace and Transport Tables, Table 3.*

as great as might have been expected. These transferred workers account for almost all of the people from South Queensferry employed by the firm; a further 90 workers, mainly managerial staff, travel out from Edinburgh.

As part of the Forth Road Bridge project a motorway was built linking the bridge to Edinburgh and, since this road passes close to South Queensferry, access to the city has been greatly speeded up. This was one of the main reasons for the location of a private housing estate on the outskirts of the town. A survey of this group of two hundred homes established that none of the families were of local origin and that almost all of the people worked in Edinburgh. In fact, being new to the district, these families tended to rely on the city for everything apart from residence.

TABLE 1. Employment characteristics of settlements and method of travel to work

	South Queen- serry	Currie	Ba- lerno	Ratho	Ratho Sta- tion	Kirk- liston	Dal- meny	New- bridge
Population	2,926	6,750	1,830	1,100	630	1,249	608	390
Number of households		1,730	500	310	250	500	120	124
Estimated total labour-force (T.L.F.)	1,840	2,800	600	403	375	750	192	199
Percentage of T.L.F. working in Edinburgh	30	80	67	62	54	53	38	39
Percentage of heads of families working in Edinburgh		85	69	68	43	50	23	30
Percentage of families with at least one member working in Edin- burgh		95	77	77	68	60	51	44
Method of journey to work	Bus	28	24	37	69	47	64	67
in Edinburgh	Car	72	76	63	31	47	27	33
(Percentage)	Train						9	

Source: Census of Scotland, 1966, and private survey

The foregoing discussion illustrates the way in which a shortage of local employment can lead to the growth of strong commuting ties with a nearby industrial centre, so much so that even when industry is introduced into the town there is no immediate change in the established work-place orientation. Improved transport facilities not only tend to re-emphasise existing movements, but may also attract new residential development because of the improved access to the city.

The villages of Currie and Balerno will be considered together, since they have many common characteristics. Both grew up around riverside mills and developed further as service centres for the surrounding agricultural area; during the inter-war period each underwent re-development and expansion in the form of local authority housing estates and to a lesser extent private ones. In the post-war years this expansion has continued, but with the private housing sector developing more rapidly than the public one. The comprehensive

range of facilities already in existence in these settlements has been a positive asset in attracting private residential development.

Being located very close to Edinburgh both Currie and Balerno had emerged as minor dormitory settlements during the 1930's, a trend that has gathered increasing momentum since the last war. Currie's population has grown from 1,101 in 1951 to 6,750 in 1965; Balerno's growth during the same period has

TABLE 2. Employment characteristics of settlements by former place of residence

		Currie	Balerno	Ratho	Ratho Station	Kirk- iston	Dal- meny	New- bridge
Former place of residence	Village	3	9	20	11	31	30	18
	Local area	10	9	20	45	26	24	44
	Edinburgh	40	32	37	24	26	6	23
	Other parts of the U.K.	47	50	23	20	17	40	15
Village	Percentage of the T.L.F. working in Edinburgh (A)	62	37	40	67	38	33	29
	Percentage of heads of families working in Edinburgh (B)	51	39	36	43	32	0	30
	Percentage of other members of families working in Edinburgh (C)	83	38	45	100	50	63	29
Local area	(A)	70	66	77	57	42	32	27
	(B)	62	55	67	50	29	25	17
	(C)	68	60	100	67	59	43	38
Edinburgh	(A)	92	69	86	57	71	57	53
	(B)	90	70	91	35	82	67	59
	(C)	100	67	71	85	56	50	57
Other parts of the United Kingdom	(A)	98	74	38	44	48	40	67
	(B)	95	76	50	36	57	35	43
	(C)	100	70	17	54	100	44	100

Source: Private survey

been much more modest, from 1173 to 1900. An analysis of the survey material (Table 2) showed that the influx of families from Edinburgh and other parts of Britain accounted for over eighty percent of the families living in these villages, a clear indication of their dormitory role, a fact that was further

emphasised by their high employment dependence on the city. Most of the new families moving into these villages did so because suitable houses were not available in Edinburgh. A breakdown of the families into groups on the basis of their former place of residence (Table 2) indicated, as would be expected, that those of local origin tended to have stronger local employment ties, especially in Balerno, where there is a large paper mill, whereas the other families are much more closely associated with Edinburgh. Although there is a regular bus service between these communities and the city three quarters of the people working in the city travel there by car, a factor which when taken in conjunction with the high owner-occupier ratio indicates the quite considerable affluence of these new families. The village shops are able to meet the everyday needs of most of the families (Table 3), but the high proportion of daily shopping visits to the city is indicative of the number of women who work there and the weekly visits point to the convenience character of the local shops. Community facilities are well developed in both villages, but the city is the main centre for commercial entertainment.

TABLE 3. Shopping characteristics of the settlements on the west side of Edinburgh

	Currie	Balerno	Ratho	Ratho Station	Kirkliston	Dalmeny	New-bridge
	Percentage of families shopping in the village or from mobile vans						
	80	69	85	80	85	65	81
Everyday shopping	Percentage of families shopping in nearby settlements						
	0	17	10	4	0	28	7
	Percentage of families shopping in Edinburgh						
	20	14	5	16	15	7	12
Weekly shopping visits to Edinburgh	Percentage of families making at least one visit						
	70	69	65	64	60	44	53
	Percentage of families making more than one visit						
	30	23	22	23	17	11	25

Source: Private survey

From this description and a further analysis of Tables 2 and 3 it would appear that both Currie and Balerno have to a large degree lost their former rural character and become dormitory settlements. The intensity of interaction between them and the city has become so great that the rural surroundings that were once the main attraction of these villages are no longer of such great importance.

The presence of both pre-war and post-war local authority housing estates provides the common link between the villages of Ratho, Ratho Station and Kirkliston. Ratho was a long-established quarrying settlement and agricultural service centre, but with the closure of the quarry Edinburgh became the only place where many the villagers could find work, a journey that many of these people made by train from Ratho Station, until this railway station

was closed. Attracted by the presence of community facilities Midlothian County Council decided during the inter-war period to build a large number of houses at Ratho and in so doing greatly increased the volume of commuting into Edinburgh. As can be seen on Table 2 the longterm shortage of local employment has resulted in the situation where even those families of local origin rely heavily on the city for work. An anomaly in this village is that families coming from other parts of the United Kingdom display a far lower employment dependence on Edinburgh than do the remainder of the community. In most cases this is due to the fact that these people have been attracted to the village because of the availability of a job in the neighbouring area. The limited range of community facilities was the main reason for the fact that only a small number of local authority houses were built at Ratho Station during the inter-war period. However, since the war the excellent transport access that the village has with Edinburgh, despite the closure of the railway station, led Midlothian County Council to develop a large housing estate at Ratho Station. This influx of people preceded the opening of the neighbouring industrial estate. In the second phase of this development the promise of houses was used to attract firms to the new estate, but at the present time the supply of houses has not kept pace with demand. However, as more houses are completed, commuting will decline and the village will become less dependent on Edinburgh; the trend can already be seen among the non-local family groups (Table 2). Another feature of employment on this industrial estate is that, since several of the firms located there have moved out from Edinburgh, many of the workers and most of the managerial staff continue to live in the city. It is expected that with time this daily movement of workers will decline, but not disappear. The availability of a limited amount of work in Kirkliston enabled this community to absorb a significant proportion of the increase in the labour-force that resulted from the location of a local authority housing estate there during the inter-war years. However, the continued influx of families since the war has meant that more and more workers have had to commute into Edinburgh, as is reflected in the relatively high city orientation, even among those families of local origin. Apart from Currie and Balerno, Kirkliston is the only other small community on the west side of the city to be selected by private house-building contractors for residential expansion, a factor that will undoubtedly draw Kirkliston into much closer contact with Edinburgh. The survey established (Table 2) that the first of these estates was already beginning to influence the work-place orientation of the non-local family groups and this will become more obvious as more of these houses become occupied.

Travel-to-work in Edinburgh from the relatively isolated Ratho was mainly by car, whereas from the much more accessible Kirkliston car and bus were equally popular, but from Ratho Station the bus was the more important means of access into the city mainly because of the village's excellent main road location.

All three villages have very similar shopping characteristics, with local shops and mobile shopping-vans accounting for over eighty percent of the everyday needs of the inhabitants and over sixty percent of the families making at least one visit to Edinburgh every week for more specialised purchases. Visits to the cinema and theatre were again mainly to Edinburgh since there were no local facilities, but because of excellent road access Ratho Station is also within easy reach of the larger mining settlements to the west.

Although these villages each developed along similar lines up until 1960 they have since begun to diverge in terms of their inter-relationships with Edinburgh. Ratho has come to depend on the city to an even greater degree for employment. Ratho Station although heavily orientated towards Edinburgh at the present time should loosen these ties in the near future, and Kirkliston, on the other hand, will greatly strengthen its links with the city. All are excellent examples of the local authority's capitalising on proximity to a major source of employment through the concentration of houses in nearby villages; only with the recent opening of the industrial estate at Ratho Station have any new industries been attracted to these settlements.

Dalmeny and Newbridge have been grouped together because of their great similarity, small village nuclei which were overwhelmed by large local authority housing estates built during the 1930's. The great majority of these new families were of local origin and have naturally retained quite strong links with the economy of the surrounding area. This and the fact that a limited amount of work was available in neighbouring larger settlements have greatly reduced the need for villagers to commute into Edinburgh, as can be seen on Table 2. As would be expected, those families of non-local origin tend to have more contact with the city, more marked in the case of Newbridge, but these groups are of minor importance in these villages. It seems unlikely that there will be any change in Dalmeny's orientation in the near future, but the opening of the industrial estate at Ratho Station will probably lead to the weakening of Newbridge's employment ties with Edinburgh. The provision of excellent bus services to both of these villages has resulted in this form of transport being more important than the car for travel into the city. Shopping is mainly carried out locally, with Edinburgh acting in its regional role as the weekly shopping centre for approximately fifty percent of the families.

The interaction between these two villages and Edinburgh is lower than that of any of the other of the adjacent communities, which would seem to indicate that local jobs were available when expansion took place during the inter-war years. The unattractiveness of these villages has acted as a deterrent to city people in search of rural homes and to private house builders contemplating out-of-town residential estates.

## CONCLUSION

In conclusion it must be emphasised that urban-rural interaction is a difficult concept to define with any degree of accuracy since there are no clear-cut limits to the area under consideration. This problem is highlighted in a small, heavily-industrialised country such as the United Kingdom, where the zones of interaction around cities often overlap. In the case of Edinburgh its role as a regional centre extends its influence over much of central and south-east Scotland. With increasing distance the intensity of interaction decreases, but this is often not as rapid as it might appear, since the intermittent contact and hidden interchange, such as shopping and entertainment visits and Edinburgh's market and transport function, can be of crucial importance. However, for the purposes of this paper the area studied has been restricted to that where intensive interaction can be observed to be taking place, i.e., the area immediately beyond the built-up limits of the city.

The form that this interaction has taken, in terms of both the types of land-uses involved and the locational pattern they have assumed, have been greatly influenced by post-war planning legislation. This is probably most clearly illustrated in the absence of extensive urban projections with their haloes of ribbon development, which were such a marked feature of the pre-war era. With present levels of car ownership and prosperity this form of city expansion could have reached disastrous proportions, resulting in severe agricultural disruption and loss of rural amenity. Through a policy of infilling a much more compact urban area has been created and the very strict controls placed upon future growth have stabilized the areal extent of the built-up area. This has been aided by the creation of a Green Belt, where recreation areas can be located and agriculture can thrive free from the threat of displacement, within easy reach of the entire city population. The success of this policy can be seen in the variety of recreation and institutional facilities that have concentrated within this zone. Interaction between Edinburgh and its Green Belt tends to be dominated by the outward movement of the urban population, but the agriculturalist makes full use of the nearby city's market potential.

The fact that employment and population growth do not cease, despite the imposition of restraints on urban expansion, has necessitated the provision of out-of-town residential estates to cope with the continued demand for houses. In addition, many people living in the surrounding districts have found work in Edinburgh. The number of commuters has increased as more and more houses have been built in the adjacent villages, with the result that in some instances the vitality of the old community is greatly reduced because the new families often do not closely identify themselves with the social life of the village. This is especially true of those families living on private housing estates, who, because they do not have long-established local ties, tend to identify themselves more closely with the nearby city. As a result, a series of satellite settlements has emerged during the post-war years, communities often without the facilities necessary to accommodate the influx of new families. This often leads to discontentment on the part of the older residents, who complain about the competition for services and by the newcomers, who feel that the services available are inferior to those they previously enjoyed in the city. However, improvement of the facilities in these villages is often not warranted because the population increase is not great enough and this results in the need to make use of the facilities available in Edinburgh. A greater degree of concentration of this house building, as has, for example, taken place at Currie and Balerno, could possibly overcome many of these irritations and reduce the need to travel into town, since the concentration of people into much larger developments would justify the provision of more service facilities and better roads than can be provided for numerous small estates.

University of Leicester

## AGRICULTURE AND NEW TOWNS IN GREAT BRITAIN

ANTHONY G. CHAMPION

In land-use terms one of the most important aspects of urban-rural interaction is the impact of urbanization on agriculture. In a country like Britain, with its relatively advanced level of technological development and high overall population density, the pressures exerted upon rural land resources are intense. Population growth and the increasing *per capita* requirements of urban land have caused the widespread extension of urban development over farmland and, at the same time, a variety of urban influences have been unleashed on the countryside around urban areas.<sup>1</sup>

In Britain little planning control was exercised over this process during the first decades of this century, but over the last thirty years successive governments have, for a number of reasons, aimed at maintaining a high level of agricultural production. This policy has been implemented partly through a system of agricultural subsidies and partly by limiting the loss of good farmland to urban uses. In the latter case, the Town and Country Planning Act of 1947 has been instrumental, for it introduced legislation designed to limit the land requirements of new urban development and to direct new growth as far as possible to areas where the least agricultural disruption would be caused.

An indication of the strength of agricultural considerations is the reduction in the rate of urban expansion and agricultural displacement since the introduction of effective planning measures. Prior to this, the area of urban land in England and Wales doubled from 0.8 to 1.6 million ha over the period 1900–1950, with the conversion of farmland to urban use reaching the unprecedented scale of 24,000 ha a year in the 1930's.<sup>2</sup> This rate of urban expansion represented a reduction of 0.2% in the agricultural area each year — not particularly large in itself perhaps, but serious in that a large proportion took place in the English Midlands and the South-East, where much of the country's better farmland is concentrated. Since 1945, however, agricultural transfers to urban development in England and Wales have fallen to an average of just over 15,000 ha a year, only two-thirds of the immediate pre-war level. Moreover, though taking a large share of the country's population growth over this period, the South-East has experienced

<sup>1</sup> G. P. Wibberley, *Agriculture and urban growth*, London, 1959.

<sup>2</sup> R. H. Best, Competition for land between rural and urban uses, Chap. 6 in: *Land use and resources; studies in applied geography (A memorial volume to Sir Dudley Stamp)*, Inst. Brit. Geogr. Spec. Publ. 1, London, 1968, 89–100.

only modest rates of agricultural-urban conversions compared with some other parts of the country.<sup>3</sup> Thus urban-rural interactions have not been one-way, with farmland lying at the mercy of urban expansion. Agricultural considerations, in their turn, have had a strong influence over the density and distribution of urban expansion.

Nowhere in Britain can this two-way interaction be observed more clearly than in the major schemes of urban development organized under the New Towns Act of 1946. New Town construction brings urban and rural interests abruptly into conflict because of the special purpose of New Towns and their method of growth. As explained by Professor K. C. Edwards at the first Anglo-Polish Seminar<sup>4</sup>, the Act's aims were chiefly to decentralize population and employment from the overcrowded areas of large cities and, more generally, to rehouse deprived sections of the community in a pleasant environment also having easy access to a balanced range of urban facilities. This involved the development of broadly self-sufficient towns, planned at a relatively low overall density and sited on virgin land within a wide rural zone. Both these last two features, advocated by the Reith Committee on New Towns<sup>5</sup>, have drawn severe criticism because it was believed difficult to reconcile spacious development and the leap into the countryside with the general policy of containment inaugurated by the 1947 Planning Act.<sup>6</sup> Agricultural interests presented particularly strong opposition, not only on account of loss of livelihood on the designated sites but also because the New Towns introduced disruptive urban influences into previously unaffected countryside.

On the other hand, however, the system of comprehensive planning introduced by the New Towns Act can help to cushion the impact of new development on the countryside. The New Towns are financed by public money loaned from the Treasury and their designation and subsequent construction are the direct responsibility of the Ministry of Housing and Local Government (M.H.L.G.) and of the public Development Corporations appointed by the Ministry. This administrative machinery potentially enables much greater heed to be paid to agricultural considerations than is possible with urban expansion elsewhere. The present paper aims to assess the effects of New Town development on agriculture and to describe the ways in which attention has been paid to farming interests.

#### LAND REQUIREMENTS FOR NEW TOWN DEVELOPMENT

By far the most conspicuous aspect of New Town growth is the conversion of rural land to buildings and other urban uses. The extent to which this occurs depends on the size of the population to be accommodated and the amount of urban land to be provided per person.

<sup>3</sup> R. H. Best and A. G. Champion, Regional conversions of agricultural land to urban use in England and Wales, 1945-67, *Inst. Brit. Geogr. Trans.* No. 49(1970), 15-32.

<sup>4</sup> K. C. Edwards, The New Towns of Britain, in: *Problems of Applied Geography, Prace Geogr.* IG PAN (Geogr. Stud.), 25, Warszawa, 1961, 141-146.

<sup>5</sup> Ministry of Town and Country Planning and Department of Health for Scotland, *Final Report of the New Towns Committee (Reith Report)*, Cmd. 6876 (London, 1946).

<sup>6</sup> F. J. Osborn and A. Whittick, *The New Towns: the answer to Megalopolis*, London, 1963 (rev. edit. 1969).

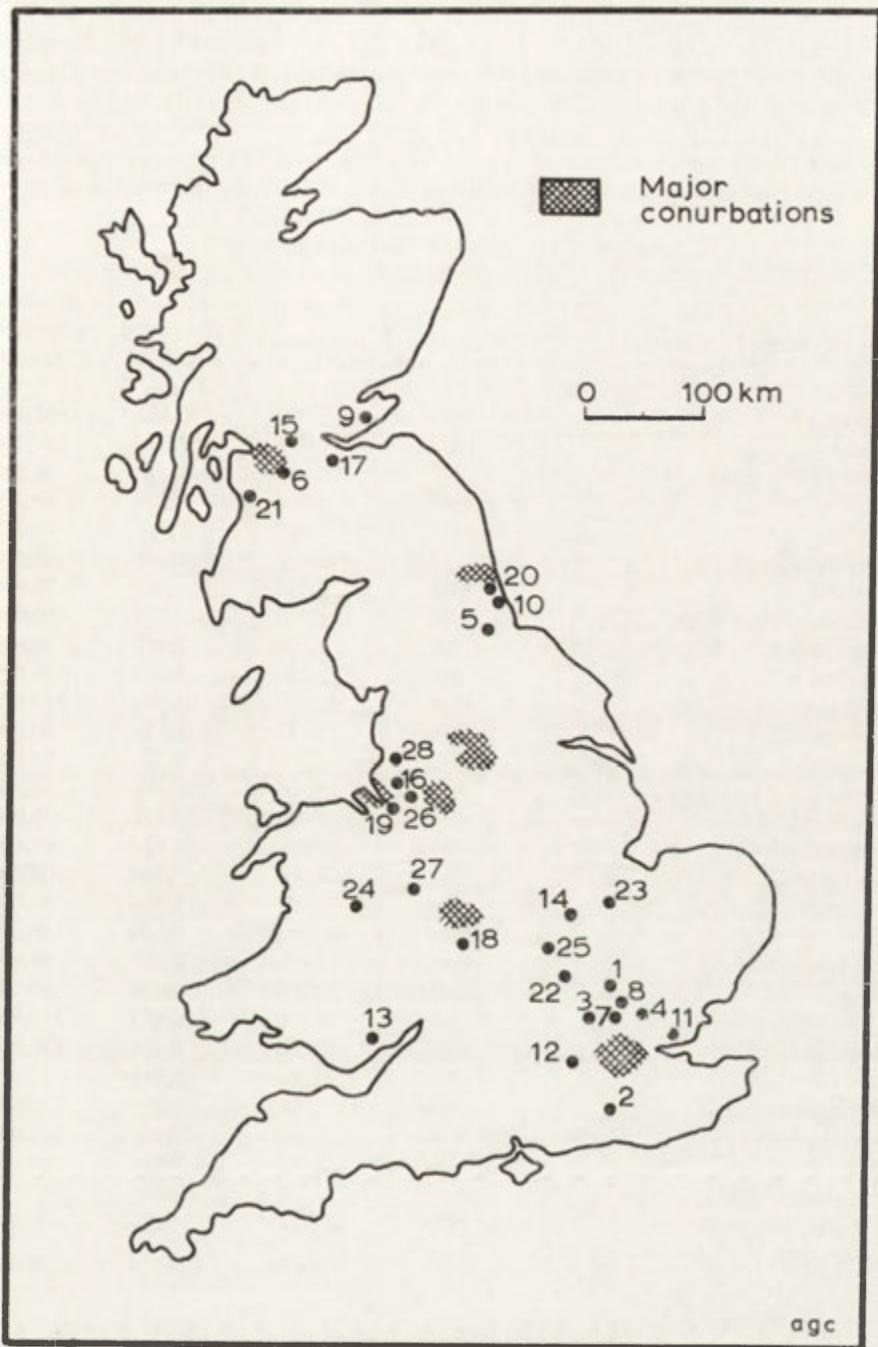


Fig. 1. The British New Towns in 1970 (The towns are numbered in order of date of designation — see Table 1)

The first fifteen New Towns, designated between 1946 and 1955 (see Fig. 1 and Table I), were the subject of a detailed study by Best,<sup>7</sup> who found that they were very modest in their land requirements. By 1960 master plans had been prepared for a total of 750,000 people, an average of only 50,000 for each town. But more important was the fact that the *per capita* space standards were much less generous than was generally believed. There was considerable variation between towns, but on average the urban land provision was only

TABLE 1. The British New Towns in 1970

New Town (in order of designation)	Year of designation	Original population	Present designated area (ha)	Proposed population target
(1) Stevenage	1946	7,000	2,532	105,000
(2) Crawley	1947	9,000	2,447	120,000
(3) Hemel Hempstead	1947	21,000	2,392	80,000
(4) Harlow	1947	4,500	6,588	90,000
(5) Aycliffe	1947	60	1,015	45,000
(6) East Kilbride	1947	2,400	4,148	100,000
(7) Hatfield	1948	8,500	947	29,000
(8) Welwyn Garden City	1948	18,500	1,747	50,000
(9) Glenrothes	1948	1,100	2,333	70,000
(10) Peterlee	1948	200	1,000	30,000
(11) Basildon	1949	25,000	3,164	140,000
(12) Bracknell	1949	5,142	1,329	60,000
(13) Cumbran	1949	12,000	1,279	55,000
(14) Corby	1950	15,700	1,790	80,000
(15) Cumbernauld	1955	3,000	1,679	70,000
(16) Skelmersdale	1961	10,870	1,631	80,000
(17) Livingston	1962	2,000	2,708	100,000
(18) Redditch	1964	29,000	2,914	90,000
(19) Runcorn	1964	30,000	2,928	100,000
(20) Washington	1964	20,000	2,145	80,000
(21) Irvine	1966	27,000	5,034	90,000
(22) Milton Keynes	1967	40,000	8,855	250,000
(23) Peterborough	1967	80,000	6,451	190,000
(24) Newtown	1967	5,500	1,497	11,000
(25) Northampton	1968	120,000	8,074	220,000
(26) Warrington	1968	124,000	7,532	205,000
(27) Telford*	1968	70,000	7,815	220,000
(28) Preston-Leyland-Chorley (Central Lancashire)	1970	253,000	14,255	430,000
Total		944,672	106,229	3,190,000

\* Originally designated as Dawley in 1963.

Note: On no account should the present population target be related to the designated area in order to derive a measure of urban density. In many cases parts of the designated areas will not be developed for urban use and in one case (Crawley) it is not intended that the proposed population will be accommodated entirely within the present boundaries.

<sup>7</sup> R. H. Best, *Land for New Towns — a study of land use, densities and agricultural displacement*, London, 1964.

22 ha/1000 persons (Table 2). This allocation was observed to be much lower than the standard of 34 ha/1000 persons recommended by the Reith Committee in 1946 and, in fact, compared very closely with the situation proposed in the Development Plans of the County Boroughs, which include the majority of the country's most congested towns and cities. The New Town densities were, therefore, much higher than in the country's other large towns, which were planning for an overall urban density of 33 ha/1000 persons, i.e. for a density over 10 ha/1000 persons more generous (Table 2).

TABLE 2. Overall Urban Densities Proposed for New Towns and Other urban Settlements

	Population planned	Total urban area (ha)	Urban land provision (ha/1000 persons)
New Towns Committee	—	—	33.6
Early New Towns in 1960 (15)	750,000	16,685	22.3
Revisions of early New Town plans after 1960 (7)	483,200	10,587	21.9
New Designations 1961-64 (5)	450,000	11,707	26.0
Designations since 1964 (4)	875,000	27,122	31.0
of which: Milton Keynes	250,000	8,495	34.0
County Boroughs	—	—	21.6
Large town map areas	—	—	32.8

Source: R. H. Best, *Land for New Towns* (1964) for details relating to the New Towns Committee, Early New Towns in 1960, County Boroughs and Large town map areas.

Since 1960, however, New Town planning has entered a major new phase, completely dwarfing the earlier programme in size and adding very considerably to its land requirements. Thirteen further sites have been designated for ultimate populations of between 80,000 and 430,000 (except the special case of Newtown, planned for just 11,000). Meanwhile, expanded master plans have been prepared for several of the first fifteen towns where population targets have been revised upwards, in some cases involving extensions to the original designated areas. Taking all twenty-eight New Towns together, the currently envisaged population reaches nearly 3.2 million, i.e., over four times the planned target of ten years ago.

At the same time space standards have become more generous than in the original New Town plans. Master plans drawn up since 1960 can be divided into three groups (Table 2). One group comprises seven of the first fifteen towns that have revised their plans in order to accommodate expanded population targets. Basildon, Cumbernauld, Glenrothes and Stevenage have revised their entire plans, while land-use data for extension areas only are available for Aycliffe, Bracknell and Corby. With these towns very little overall change is apparent, the revised density still being only some 22 ha/1000 persons, perhaps because of the weighting of the large area of earlier development in the first four. Second are the proposals for the New Towns designated between 1961 and 1964 (Livingston, Redditch, Runcorn, Skelmersdale and Washington). The land provision for these five towns averages 26 ha/1000 persons, a density more generous than that in the earlier plans by some 4 ha/1000 persons. Lastly, four of the eight towns designated since 1964 (Milton Keynes, Peterborough,

Telford and Warrington) have produced master plans with sufficiently detailed land-use statistics to enable the calculation of overall urban densities. These four average 31 ha/1000 persons, again a substantial increase in land provision over the previous group.

In this way, perhaps rather surprisingly, it is the earliest New Towns which depart most radically from the density recommendations of the Reith Committee. While up to 1960 the master plans allocated a land provision some 12 ha/1000 persons less than the prescribed standard, the most recent plans are only about 3 ha/1000 persons lower on average. Much of the increase of 9 ha/1000 persons over the last ten years can be attributed to more generous standards of urban open space, particularly land for informal recreation and general amenity. On the other hand, very recently there has been a trend towards the relaxation of housing densities. During the 1950's and early 1960's the land allocation for net residential area had steadily been cut back from an average of 11 to about 8 ha/1000 persons, but now planning policy is attempting both to provide more attractive housing for the wealthier and to allow more flexibility in the long term.<sup>8</sup> The plans for Milton Keynes, in particular, allocate 16 ha/1000 persons for housing and have been welcomed as a "return to the Garden City".<sup>9</sup> Even so, its overall urban land provision of 34 ha/1000 persons — the most generous of the New Towns so far — is almost the same as the original Reith recommendations and is only marginally greater than the standard proposed in the map areas for large towns (Table 2).

#### IMPLICATIONS FOR AGRICULTURAL LAND

Though the New Towns are thus continuing to plan for densities similar to, or rather higher than, those prevailing in other large towns, the changes in planning policy over the last ten years will have important repercussions on the rate of urban expansion and agricultural displacement generated by New Town construction. Best calculated that up to 1960 urban development in the New Towns had averaged only some 600 ha a year and represented just 4 per cent of the country's total agricultural-urban conversions. In all, the first fifteen towns had designated areas adding up to 28,000 ha, but only 59 per cent of this area was scheduled for urban development in 1960.<sup>10</sup> Subsequently, with the expansion of the New Towns programme and the lowering of urban densities, the rate of development has experienced a distinct upturn, averaging 1200 ha a year — double its earlier rate — between 1965 and 1969 and accounting for a total of 9500 ha over the whole decade (Table 3). Altogether the area designated under the New Towns Act has risen to 106,000 ha (Table 1) and as much as 90% of the land in the post-1960 sites is currently planned for urban use. Nearly all these schemes are set for completion before the end of the century, so over the next two or three decades the rate of urban expansion in New Towns can be expected to continue at, or even surpass, the higher level of recent years.

Set against this, however, is the consideration that, as explained in the introductory remarks, the special nature of New Town planning allows some

<sup>8</sup> A. G. Champion, Recent trends in new town densities, *Town Ctry Plann.* 38(1970), 252-255.

<sup>9</sup> A. Whittick, Return to the garden city, *Town Ctry Plann.*, 37(1969), 151-155.

<sup>10</sup> R. H. Best, 1964, *op. cit.*, p. 34.

scope for moderating its impact on agricultural land. This is particularly true at the designation stage, when attempts are made to locate new schemes away from better-quality land. Reference is made to surveys of land quality both in a regional context in the selection of a suitable site and at the local scale in delimiting the boundaries of the designated area. Then, following the announcement of the draft designation order, a public inquiry is held if local interests wish to present formal objections. At this stage, too, the Minister may adjust the boundaries if he feels that too much good farmland has been included.

TABLE 3. Rate of New Urban Development in the British New Towns

Period	New development in period (ha)	Average rate of development (ha/year)
1946-55	5020	558
1955-60	2890	578
1946-60	7910	565
1960-65	3350	670
1965-70	6170	1234
1960-70	9520	952

Note: Figures include land in the course of development. Periods taken as ending on 31 March of the respective years.

Source: Calculated from the land-use summaries presented in the Annual Reports of the Development Corporations.

Many examples can be cited to indicate the extent to which modifications have been made in the original plans. A number of sites recommended for new towns in Abercrombie's Greater London Plan (1944) were rejected on agricultural grounds, while Best quotes several instances where the draft designated areas of the first fifteen New Towns were reduced in size in order to save agricultural land.<sup>11</sup> In several of the post-1960 New Towns, too, land-quality maps prepared during the pre-designation stage have influenced the orientation of boundaries. At Runcorn, for instance, a large area of first-class agricultural land to the south of the town was avoided. Even so, public inquiries have brought about further adjustments. Another 200 ha were excluded from the draft designated area at Runcorn, while among the latest orders 195 ha were omitted at Telford, 1,150 ha at Warrington, 1,335 ha at Milton Keynes, and 2,355 ha at the Central Lancashire site (the last not entirely for agricultural reasons).

When attempting to assess the achievement of this policy, there are several factors to take into account. In the first place, as already mentioned, not all the land within the designated areas is planned for urban use. In the early master plans, 41% was to be left in rural state, compared with 10% in the more recent ones. Yet this latter amounts to some 6000 ha. Then again, not all parts of the designated areas were in productive agricultural use at the time of designation. Much land was already in urban and semi-urban use, was wooded or was lying vacant. The Reith Committee

<sup>11</sup> *Ibid.*, p. 39.

recommended that the New Towns should be constructed on relatively undeveloped sites, but, as it turned out, the first fifteen sites had a total pre-designation population of 133,000. Taking 30 ha/1000 people as a rough estimate of their original urban land provision, it can be calculated that these towns contained at least 4000 ha of pre-existing urban land, which thus constituted 14% of their designated areas. Figures are not available for all these towns, but for instance at Basildon, with 25,000 people at designation, farmland amounted to only some 1400 ha and the remaining area of some 1740 ha was made up of sporadically developed urban land and vacant land awaiting development. With the post-1960 New Towns (excluding Central Lancashire), no more than 60% of the land was in agricultural use at designation. This partly reflects the much higher original populations of recent sites (Table 1), but it also indicates some success in locating New Towns on land which is ripe for redevelopment. Such is the case with the large worn-out mining areas included at Telford and Washington and with the three major derelict sites at Warrington.

Bearing these two features in mind, it is interesting to take a broad look at the intrinsic land quality of the designated areas, in order to obtain an overall impression of the strength of agricultural considerations in New Town planning. The trend is very clear. Best studied the sites of the first fifteen towns by reference to the Dudley Stamp land-classification maps and estimated that nearly 60% of their land was in the "good" category.<sup>12</sup> By contrast, the same maps indicate that "good" farmland comprises some 85% of the thirteen more recently designated sites and that several of them consisted entirely of this category. Furthermore, at Irvine, Skelmersdale and Warrington, over half the sites are made up to first-class land (Groups 1 and 3 of the Stamp grading), whereas all such land was avoided by the earlier towns.

Though these figures compare unfavourably with the national proportion of "good" land (only 39%), this situation is not difficult to understand. The New Towns, though generally located at some distance from the main population concentrations (Fig. 1), are situated within the broad regions of most rapid urban growth and thus in the areas where the proportion of "good" land is well above average. Even in the early post-war period the Ministry reported difficulty in finding suitable sites of about 2500 ha without making serious inroads on good agricultural land.<sup>13</sup> Since then, the trend towards considerably larger sites of between 4000 and 6000 ha or more has aggravated the problem. A contributory factor is that official attitudes towards the conservation of agricultural land have been evolving since the Second World War, particularly in relation to large-scale schemes like the New Towns. At that time, planning policy was dominated by the recommendations of the Scott Committee that good agricultural land should be conserved if at all possible.<sup>14</sup> More recently, however, there has been greater acceptance of the view, advocated by Dennison's minority report to the Scott Committee, namely that agriculture should not be given preferential treatment in land-use planning.<sup>15</sup>

Judging by the boundary adjustments at the designation stage, the M.H.L.G. still aims to avoid the unnecessary use of first-class farmland. It has also taken advantage of vacant land where it is suitably located. On the other hand, it

<sup>12</sup> Personal communication with R. H. Best.

<sup>13</sup> Ministry of Local Government and Planning, *Town and Country Planning 1943-51*, Cmd. 8204 (London, 1951), p. 124.

<sup>14</sup> Ministry of Works and Planning, *Report of the Committee on Land Utilization in Rural Areas (Scott Report)*, Cmd. 6378 (London, 1942).

<sup>15</sup> *Ibid.*, *Minority Report* by Professor S. R. Dennison, 100-123.

is now tending to give other factors more weight than previously. In the first place, the space standards of New Town plans have been raised towards the level considered suitable for most other towns. Secondly, more scope is now being given to economic consultants and urban planners in deciding the location, size and form of New Town expansion. As a result, more good farmland has been included in recently designated sites than previously. At the same time, however, this does not necessarily mean that New Towns are taking better land than other forms of urban expansion. Other large towns and cities have to grow by peripheral extension and thus have less opportunity than the New Towns of being selective in their land requirements. However, there is no recent work to test this contention.

Before leaving the subject of New Town land requirements, it is also important to point out that, despite its diminishing land resources, British agriculture has been able to maintain and even increase its overall production. Over the last two decades agricultural land transfers to all types of urban development have averaged 18,000 ha a year in Britain, a rate which represents an annual loss to the country's agricultural area of rather less than 0.1%. Yet over this time rising yields per unit area have not only fully compensated for this level of land loss but have also allowed an average increase of 2-3 per cent a year in the gross output and net output of the industry.<sup>16</sup> Against this background the impact of the New Towns would seem very slight. The new schemes announced since 1960 (excluding Central Lancashire), together with outstanding commitments from the first fifteen New Towns, involve the sterilization of 42,000 ha of rural land at the most; 31,000 ha for the newly designated sites and 11,000 ha for the completion of the earlier series. As over 9000 ha of this land have already been developed between 1960 and 1970 (Table 3), the future requirements for the currently envisaged programme amount to some 33,000 ha. This is about 5% of the total urban expansion anticipated to take place over the next thirty years — similar to the proportion experienced up till now — and appears very small in relation to the country's 18 million ha of agricultural land.

#### OTHER EFFECTS ON AGRICULTURE

Besides the actual displacement of agriculture by urban development, there are several other ways in which town expansion can affect the farming situation. Two opposed sets of factors are recognizable. On the one hand, town expansion can stimulate the local market for certain farm produce which cannot withstand long-distance transport. This gives rise to a surrounding belt of more intensive farming in the way predicted by von Thünen. On the other hand, by contrast, are the factors which lead to the overall reduction of output in the rural-urban fringe. Sinclair has noted a recent tendency towards the reversal of von Thünen's model in areas close to towns.<sup>17</sup> In the main, this reflects the disruption of agriculture by town influences (birds, dogs, trespass, litter, pilfering) and by the steady peripheral growth of the urban area, which stimulates intense speculation in land and often results in the premature abandonment of farming activities.

<sup>16</sup> A. Edwards, Land requirements for United Kingdom agriculture by the year 2000 — a preliminary statement, *Town Ctry Plann.*, 37(1969), 108-115.

<sup>17</sup> R. Sinclair, Von Thünen and urban sprawl, *Ann. Ass. Amer. Geogr.*, 57(1967), 72-87.

In the case of the New Towns, it is unlikely that urban growth will greatly stimulate the intensification of farming activities in the local area, because nowadays transport improvements are increasing the comparative advantage of areas which are inherently most suitable for their production. However, the negative factors noted by Sinclair are potentially a very serious problem for the New Towns. Whereas farming interests round large established towns anticipate steady urban expansion, plans for large-scale development on comparatively open sites suddenly introduce disruptive urban influences to previously unaffected land.

Yet, because of the special nature of the New Town planning process, there are a number of ways in which these consequences can be minimized. First, the Development Corporations are expected to maintain agricultural production for as long as is practical on land destined for development. Where a Corporation acquires land considerably in advance of requirements, attempts are made to let fields to tenant farmers. Such a situation may arise through having to buy a whole farm at once, even though only part is required immediately, or as a result of the stipulation that, after seven years have elapsed from the date of designation, the New Town authorities are obliged to buy any land within their administrative boundaries should notice to purchase be served by its owner.<sup>18</sup> This feature is likely to become more common with the trend towards larger schemes like Milton Keynes. Here the agricultural consultants recommend the wholesale acquisition and restructuring of farm units for re-letting, so as to fit in best with the planned phasing of development.<sup>19</sup>

The continuation of agricultural production until the time of development has also been encouraged by the removal of the incentive to speculate in land. This has been achieved by modifying for New Towns the methods for assessing compulsory purchase prices. Under the current legislation compensation is calculated mainly on the basis of existing-use value and disturbance costs, together with only that speculative value which does *not* derive from the prospect or actuality of New Town development. Thus, though the construction of a New Town can be expected to create a regional peak in land values<sup>20</sup>, the benefit accrues to the community (in the form of the Development Corporation) instead of going to private individuals. Besides reducing the overall cost of development, this policy ensures that speculation does not interfere with agricultural activities on New Town sites in the ways experienced at other rapidly expanding towns.

Third, the more recent towns are planned in such a way as to reduce the disturbance caused to surrounding farmers. As already noted, the original policy was to include a broad zone of agricultural land inside the designated area, but this gave farmers the feeling of insecurity, believing (not without some justification) that their land would eventually be taken for urban use. In the post-1960 towns, therefore, only 10% of the land is planned to remain in rural state. In many of the earlier plans, particularly at Harlow and Stevenage, large wedges of agricultural land were designed to penetrate the urban area and provide the towns with "rural lungs". But in more recent schemes such wedges have been designated for public open space, while the

<sup>18</sup> F. Schaffer, *The New Town story*, London, 1970, 62-81.

<sup>19</sup> M. A. B. Boddington, *Agriculture in Milton Keynes*, The Plan for Milton Keynes, Techn. Suppl. No. 9 (Milton Keynes Development Corporation, forthcoming).

<sup>20</sup> B. Goodall, Some effects of legislation on land values, *Reg. Stud.*, 4(1970), 11-23.

outer parts of the towns have been allocated to uses which form a containment belt round the main residential areas. A good example of this policy is afforded by the proposals for Runcorn, where industrial estates, motorways and railway lines leave very little room for pedestrian interference with surrounding agricultural land (Fig. 2).

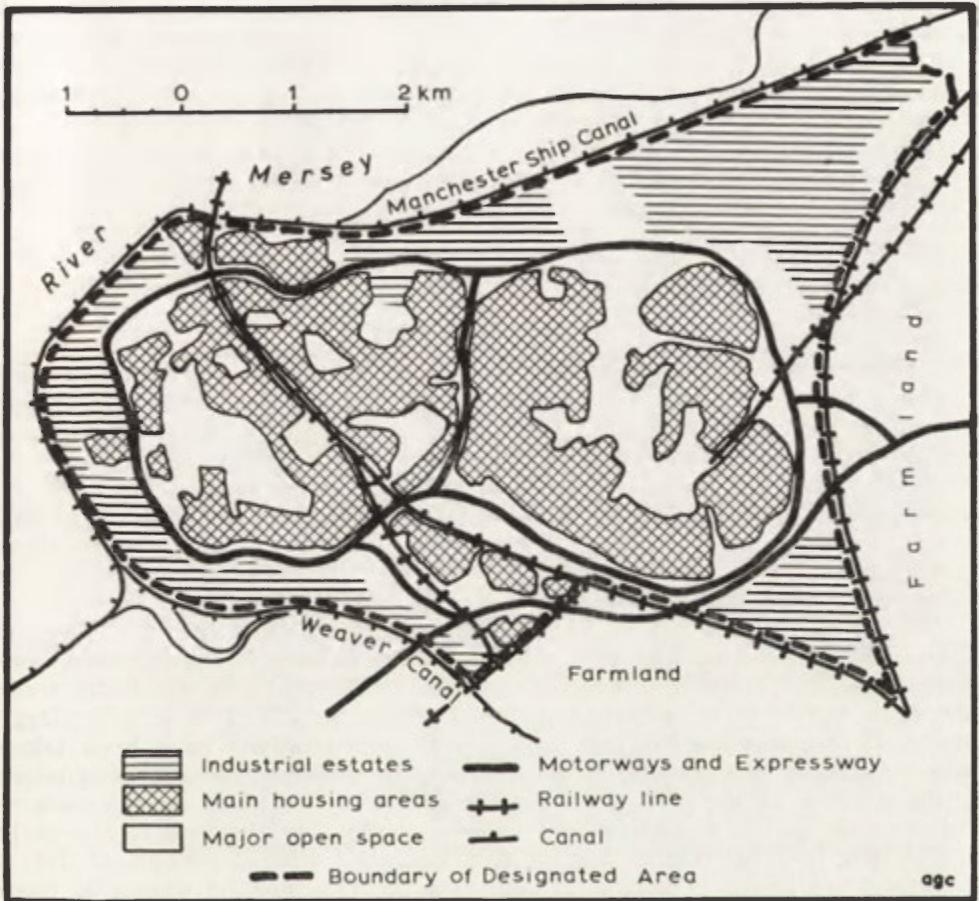


Fig. 2. Master plan of Runcorn New Town

These three features of New Town planning can to a large extent mitigate the difficulties of maintaining agricultural production on the urban fringe. On the other hand, the impact of the New Towns is likely to be felt much further afield than their immediate vicinity — often in ways over which there is little control. Despite the generous provisions of public open space in recently designated New Towns, it is certain that their future inhabitants will travel much more widely to satisfy their demand for outdoor recreation. Then again, as Ruth Gasson has observed, urbanization brings new people into the countryside with a variety of motives for buying land, many involving part-time

farming.<sup>21</sup> These people, together with farmers displaced from a New Town site, will cause an increased demand for agricultural holdings over a wide surrounding area and will bring about a general rise in farm values.

It is not clearly known how much impact these factors have had, or are likely to have, on agriculture round New Towns. A study by the Agricultural Land Service in 1952<sup>22</sup> indicated that little change was occurring in the structure of agriculture round Stevenage, Crawley and Harlow, but the little development which had taken place by that time cannot be compared with the large scale of recent proposals, particularly in view of the general intensification of urban-rural interactions since that time. Just now the subject is considered sufficiently important to warrant the attention of several research projects. Among them, the University of Reading is tracing the progress of agricultural change at Milton Keynes as the new city grows, while the Ministry of Agriculture is carrying out a wider survey of farming round urban areas, including the New Towns.

## CONCLUSION

A central theme in British land-use planning over the last three decades has been the maintenance of a high level of agricultural production. This policy has been implemented in the face of the increasing pressures made on rural land resources by urban expansion. In this process of interaction, agriculture has suffered in two ways; by the conversion of farmland to urban use and by the lowering of production on land surrounding new urban development. The New Towns have been severely criticized on both accounts; for developing more land than necessary and for causing the penetration of disruptive urban influences into previously unaffected areas.

The available evidence indicates that the accusations on the first account are largely unjustified and that the interaction has by no means been one-sided. The New Town have been planned at space standards which are similar to, or rather less generous than, those characteristic of most other large towns. It is also apparent that agricultural considerations have been taken into account at every stage of the development process — at the designation of the site, during the period of construction, and in the plans for the completed town. In fact, a strong two-way interaction can be observed in the early New Town, for, notwithstanding its disturbance by urban development, farming itself has had a powerful influence on the location and design of town growth.

On the other hand, there is developing a tendency towards giving greater weight than previously to non-agricultural factors in the siting and planning of New Towns. This trend is partly reflected in the lower density of the latest master plans, but it is also seen in the higher quality of agricultural land being used for the post-1960 series of designations compared with the first fifteen

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<sup>21</sup> R. Gasson, *The influence of urbanization on farm ownership and practice* (Wye College, University of London, 1966).

<sup>22</sup> Agricultural Land Service Research Group, *The effects of town growth on the countryside; Study No. 2 — The New Towns of Stevenage, Harlow and Crawley* (Ministry of Agriculture and Fisheries, 1953, cyclostyled).

towns. Yet it remains for future research to show whether or not New Town development is taking more first-class farmland than other urban expansion. Similarly, there is as yet inadequate information to assess the impact of the New Towns on surrounding agriculture. By careful planning a New Town can minimize the direct consequences of urban growth, but its more subtle effects on land values, labour demand, and regional recreation space, for instance, are not fully understood and may be significant and widespread.

Oxford University



URBAN-RURAL RELATIONSHIPS, WITH SPECIAL REFERENCE  
TO THE IMPACT OF CRAWLEY NEW TOWN

BRIAN G. CLARKE

In general urban-rural relationships may be divided into two groups. There are those which involve movement across some defined boundary, such as migration, journeys to work, telephone connections and shopping visits. Secondly, there are those involving no such movement. These include political or perceptual images. The two groups may perhaps be re-defined as those in which spatial differentiation is explicit and those in which it is implicit. This paper accepts such a division and therefore falls into two sections. The first is concerned with geographic relationships between an urban area and its surrounding rural area. The second analyses the political and developmental relationships between these two areas and suggests the importance of these for both areas.

Any such study can involve problems of methodology and definition. Perhaps the greatest of these is what is, or is not, "urban" or "rural". Work by Pahl [12], Stewart [16] and Dewey [6] typifies the problem, which is made more acute by the fact that the whole of the area under study in this paper lies within 40 miles (65 km) of the centre of London. For the purposes of this paper the urban/rural boundary has simply been defined as the local government boundary between Crawley Urban District and its surrounding Rural Districts.

Crawley New Town is sited thirty miles (48 km) due south of London (Fig. 1). Originally a small market and commuter centre situated at a junction of three railway lines and major north-south and east-west roads, it was designated a New Town in 1947. Development was started in 1950/51, and the population of the designated area rose from 11,000 in 1951 to 63,000 by 1966. During this same period employment rose from 8,074 to 37,807.

Prior to the development of the New Town the area was administered by East Sussex, West Sussex, and Surrey County Councils and, at a lower level, by several Rural District Councils. In 1956 the town was constituted an Urban District by the amalgamation of parts of Horsham, Cuckfield and Dorking and Horley Rural Districts. The whole was placed under the jurisdiction of West Sussex County Council. In 1964 the town became of sufficient size to take over additional local government functions, including certain aspects of planning.

The picture is one of a rapid population and employment growth in and near Crawley. This has resulted in an unusual age-sex structure for the town, with the high representation of the young adults and young children. This growth has been complemented by growth within the surrounding rural areas. The

population of the five Districts surrounding Crawley has risen from 120,594 in 1951, to 162,536 in 1966, an increase of 33.0% (Table 1). This increase has been mirrored by house-building rates. An average of some 970 houses in Crawley and 2100 within the surrounding area, were constructed every year

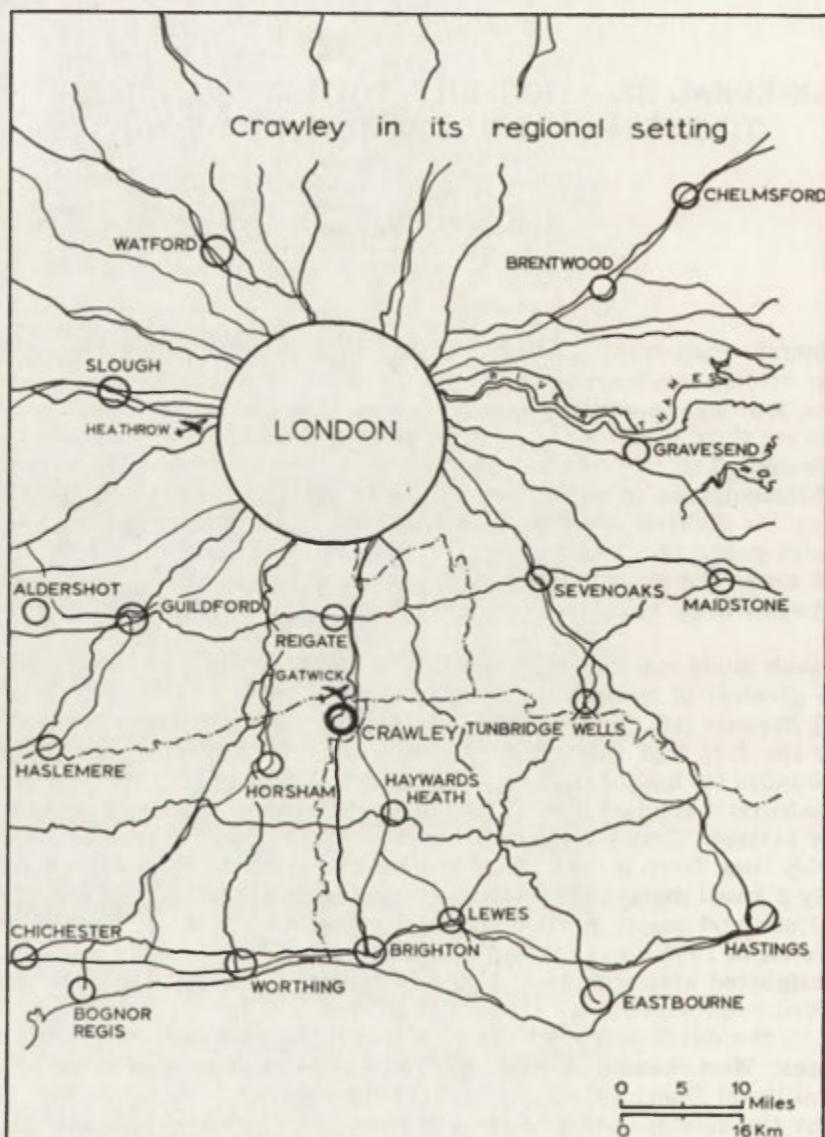


Fig. 1.

from 1951 to 1966, although this latter figure also includes construction in certain nearby towns. At present house-building has been severely limited in these surrounding areas under a policy of strict planning control, and has also been limited within Crawley as a result of national monetary restrictions on New Town development.

The socio-economic structure of Crawley and that of its surrounding rural area are rather similar (Table 2). In both cases the proportion of employed professional males is near 8.00%. This is somewhat lower than the percentage in nearby towns. One noticeable difference is the high proportion of skilled manual workers living within Crawley (40.40% in 1966), compared with, for

TABLE 1. Population changes in and around Crawley New Town

	Population 1951	Population 1961	Annual average increase 1951-61 (%)	Population 1966	Annual average increase 1951-66 (%)	Total population increase 1951-66 (%)
<b>W. Sussex</b>						
Crawley U.D.	10,481	53,768	41.3	63,807	14.7	508.8
Horsham U.D.	16,682	21,198	2.7	24,957	3.3	49.6
Horsham R.D.	20,989	22,631	0.8	25,862	2.9	23.2
<b>E. Sussex</b>						
Cuckfield R.D.	24,268	30,095	2.4	34,832	2.1	43.5
<b>Surrey</b>						
Dorking and Horley R.D.	25,832	31,710	2.3	33,866	1.4	31.1
Godstone R.D.	31,823	40,225	2.3	43,019	1.4	31.1
<b>Total without Crawley</b>						
	120,594	145,859	2.4	162,536	2.2	34.8
<b>Total</b>	<b>131,075</b>	<b>199,627</b>		<b>226,341</b>		<b>72.7</b>

TABLE 2. The socio-economic structure of the Crawley area, 1961-66

	Crawley U.D.		Horsham U.D.		Horsham R.D.		Dorking R.D.		Godstone R.D.		Cuckfield R.D.	
	1961	1966	1961	1966	1961	1966	1961	1966	1961	1966	1961	1966
Professional	5.6	7.8	6.9	6.7	5.2	7.1	8.0	7.3	9.3	9.6	7.4	8.6
Managerial	8.9	10.0	14.7	17.4	17.6	16.8	16.7	18.7	22.5	19.1	21.0	18.8
Skilled manual	43.1	40.0	36.2	34.8	33.0	31.9	29.6	30.0	26.6	28.5	28.6	24.5
Non-manual	21.9	21.5	22.4	24.2	13.7	14.9	20.4	21.6	17.9	19.1	16.6	17.0
Semi-skilled	13.0	14.8	11.7	10.8	21.0	21.3	17.7	13.8	16.8	17.6	19.9	14.1
Unskilled/ /others	7.5	5.5	8.1	6.1	9.5	8.0	7.6	8.6	6.9	6.1	6.5	7.0

Source: Census of 1961 and 1966.

example, 30.00% in Dorking and Horley R. D. From surveys carried out there seems little difference in average incomes between the two areas, but there is inferential evidence that the range of income levels is much greater in the rural areas than in Crawley.

In summary these basic statistics would suggest that in social or demographic terms Crawley and its surrounding areas show some degree of similarity.

TABLE 3. Male journey-to-work movements in and around Crawley New Town, 1966

	Receiving Local Authority Area														TOTAL			
	Crawley UD		Horsham UD		Horsham RD		Dorking & Horley RD		Godstone RD		Cuckfield RD		County of London		Other			
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
Crawley U.D.	13,900	73.8	280	1.5	90	0.5	1,930	10.2	40	0.2	110	0.5	1,630	8.7	850	4.6	18,830	100.0
%	66.1	.	4.3	.	1.7	.	16.0	.	0.5	.	0.2	.	.	.	.	.	.	.
Horsham U.D.	530	7.5	3,920	55.3	720	10.2	250	35.0	.	.	.	.	1,120	15.8	540	7.7	7,080	100.0
%	2.5	.	60.0	.	13.8	.	2.1	.	.	.	.	.	.	.	.	.	.	.
Horsham R.D.	440	6.0	1,420	19.5	3,610	49.5	220	3.1	.	.	60	0.8	760	10.5	780	10.6	7,290	100.0
%	2.1	.	21.7	.	69.0	.	2.0	.	.	.	1.0	.	.	.	.	.	.	.
Dorking & Horley R.D.	740	7.4	60	0.6	.	.	4,510	45.2	140	1.4	.	.	2,380	23.9	2,140	21.5	9,970	100.0
%	3.5	.	0.9	.	.	.	37.3	.	1.9	.	.	.	.	.	.	.	.	.
Godstone R.D.	470	3.8	.	.	.	.	450	3.7	5,420	44.2	40	0.3	3,600	29.4	2,270	19.6	12,250	100.0
%	2.2	.	.	.	.	.	3.8	.	74.2	.	0.7	.	.	.	.	.	.	.
Cuckfield R.D.	1,150	11.8	.	.	150	1.5	200	2.1	.	.	4,010	41.3	1,670	17.2	2,530	26.1	9,710	100.0
%	5.5	.	.	.	2.9	.	1.7	.	.	.	74.5	.	.	.	.	.	.	.
County of London	860	.	110	.	.	.	660	.	350	.	.	.	N/A	N/A	N/A	N/A	N/A	N/A
%	4.1	.	1.6	.	.	.	5.5	.	4.8	.	.	.	.	.	.	.	.	.
Other	2,950	.	740	.	660	.	3,880	.	1,350	.	1,160	.	N/A	N/A	N/A	N/A	N/A	N/A
%	14.0	.	11.5	.	10.6	.	31.6	.	18.6	.	21.8	.	.	.	.	.	.	.
TOTAL	21,040	.	6,530	.	5,230	.	12,100	.	7,300	.	5,380	.	N/A	N/A	N/A	N/A	N/A	N/A
%	100.0	.	100.0	.	100.0	.	100.0	.	100.0	.	100.0	.	.	.	.	.	.	.

Source: Census of 1966.

It might, therefore, be expected that urban-rural relationships in the area would be similar to those found within the intra-urban situation, at least between similar socio-economic groups or age groups. Evidence however, is to the contrary, and suggests that differences are of importance to both the present situation and the future development of the area.

Explicit or direct spatial relationships between the areas may be grouped for the purposes of this paper into migration relationships, employment relationships, retail relationships and service relationships.

## EXPLICIT RELATIONSHIPS

### MIGRATION RELATIONSHIPS

Unfortunately, migration data for the area are limited. The 1966 Census showed that migration was taking place from Crawley outwards towards the rural areas, but that this was considerably overshadowed by migration into the town. However, little is known as to the socio-economic composition of this migration stream. In view of the high percentage of owner-occupied housing within the surrounding rural areas it can be assumed that many migrants are moving to these houses. Whether they are moving from similar housing in Crawley is not clear. The whole situation is further complicated by the considerable migration taking place from London or its suburbs, especially by the families of commuters. This competition for housing, created by local population increase, family fission, and by two migration streams, has inflated house prices generally. The differential between house prices of new houses within Crawley and those outside has been further increased by house construction and occupation controls imposed by the Crawley Commission for the New Towns, perhaps thereby limiting migration from the New Town.

### EMPLOYMENT RELATIONSHIPS

The study of employment relationships shows both the local impact of Crawley and the overall dominance of London. From the rural areas up to 58.7% (Cuckfield R. D.) travel out to work each day (Table 3). After allowing for work movements into the area this still represents a considerable net loss.

TABLE 4. Socio-economic characteristics of commuters to London from Crawley and surrounding area, 1961

Socio-economic group	Crawley U.D. Commuting of total workforce (%)		Surrounding area Commuting of total workforce (%)	
	Total	Category	Total	Category
Employers and managers	10.2	12.2	26.5	32.4
Professional	14.3	28.6	15.0	42.2
Clerical	46.9	12.3	45.2	22.7
Own-account workers	1.0	5.3	0.7	2.8
Skilled manual	16.8	4.6	7.9	6.0
Semi-skilled manual	8.2	3.7	2.7	2.2
Unskilled	2.6	2.6	1.3	3.4
Armed Forces	.	.	0.7	11.5
TOTAL	100.0	8.1	100.0	15.6

Much of this loss is represented by commuters to London. Notably the workers travelling out towards London tend to be from the professional and clerical groups (Table 4), that is to say they are typical commuters. This pattern is reinforced when compared with the numbers of passengers using local railway stations to travel to London each day (Table 5). This dominance is, however, less apparent at Crawley, where journey-to-work movements show a net gain.

TABLE 5. Average number of passengers per day travelling by rail from stations in the Crawley area, 1964

Station	Towards London		Away from London		Total	
	Numbers	Numbers per 1,000 population	Numbers	Numbers per 1,000 population	Numbers	Numbers per 1,000 population
Crawley	1,043	17.6	791	13.4	1,834	31.0
Dorking	1,466	62.7	1,092	47.4	2,558	110.1
East Grinstead	1,231	75.1	122	7.4	1,353	82.5
Haywards Heath	5,026	227.7	3,323	150.6	8,349	378.3
Horsham	2,957	127.2	1,025	44.1	3,982	171.3
Redhill	4,182	75.8	2,656	48.6	6,838	124.4

Source: British Rail.

A total of 4930 male workers travelled out of Crawley U. D. to work each day in 1966. Of these 47.6% were employed locally, i.e., within the surrounding Rural Districts. Some 6,040 travelled into Crawley to work each day, and 36.9% of these came from the immediate surrounding areas. The numbers travelling into Crawley varied from 6.0% of the local male labour-force of Horsham R. D. to 11.8% of that of Cuckfield R. D. This should be compared with the 29.4% of the male work-force of Godstone R. D. travelling to London each day (Table 3). Of those working in Crawley, it must be remembered that many are not indigenous; rather are they migrants moving to work in Crawley who, for reasons of choice or because of a housing shortage within the town, are not able to reside there. However, employment within Crawley is growing rapidly; between 1959 and 1966 it rose from 20,407 to 33,056, and the town, after a slow start, is increasingly attracting employees from the surrounding areas.

#### SERVICE RELATIONSHIPS

During 1958, when Crawley Town Centre was being constructed, it was assumed that it would be used by both local residents and the surrounding population. It was hoped that this "hinterland" would contribute to the economic viability of the centre. Some 600,000 sq. ft. (55,740 m<sup>2</sup>) of retail space was therefore provided. It was feared by nearly all other neighbouring towns, notably Horsham and East Grinstead, that this would involve the rundown of their own centres. This fear has not been justified. The period over which it has taken Crawley Town Centre to become viable has been considerably longer than estimated in spite of a faster town growth-rate than originally predicted. Its impact seems to have been limited for two reasons. Firstly, the population of the whole area has grown faster than predicted. More money has been available for retail purchases throughout the whole area. Secondly, Crawley has not proved as attractive as its floorspace would suggest to both its "hinterland" and its local population.

The study of retail provision and use is one which has evoked much attention from geographers, economists and others concerned with spatial patterns and from retailers and marketing experts concerned with the profitability of sites

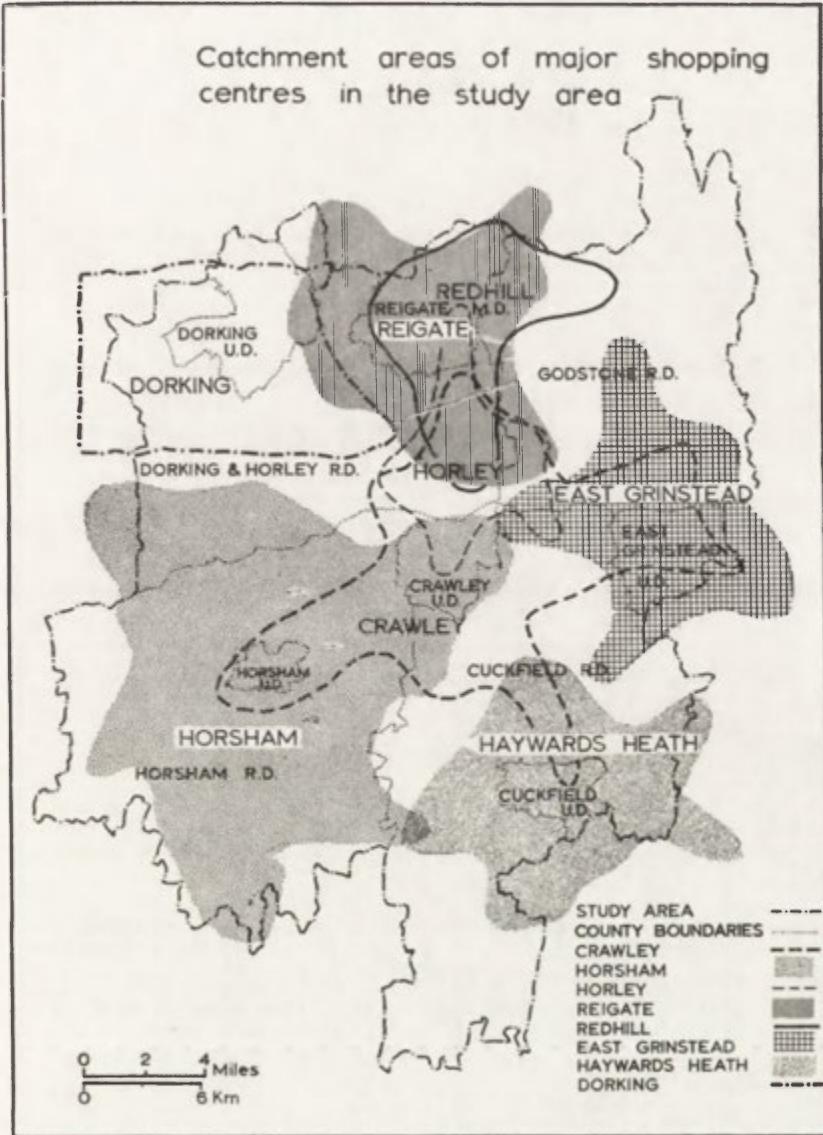


Fig. 2.

or locations. A full or detailed appreciation of the factors involved in the viability of Crawley as a retail centre is not within the scope of this paper. The important facts are, however, summarised below.

Although the dominance of Crawley as a centre is unchallenged in terms of gross floorspace or turnover, this is not true in all sections of its retail

economy. It is known that retail expenditure depends upon some function of retail opportunity-distance, intervening opportunities, ease of access and travel mode, and disposable incomes, plus a number of other factors, including

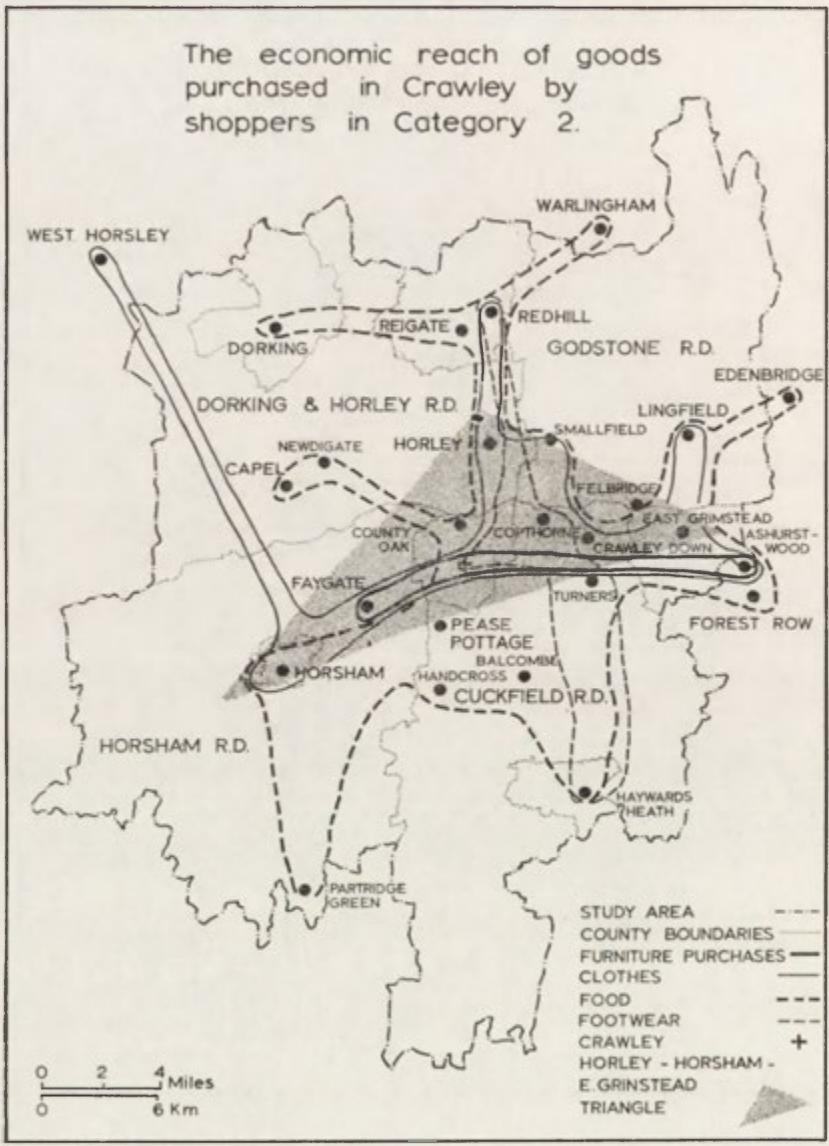


Fig. 3.

consumer attitude. Also work by Rushton [14], and later by Clarke and Bolwell [3], has suggested that consumer space-preferences can be extremely important in determining the success of a retail centre.

Around Crawley there are some seven town-centres competing for trade. Each centre is within nine miles (14.5 km) of at least two competing centres, and Crawley has all six other centres within ten miles of itself. Figure 2 shows

the approximate catchment areas of these centres. There is considerable overlap in and near Crawley. The data supplied for the analysis of retail inter-relationships was collected and jointly analysed by the present author and

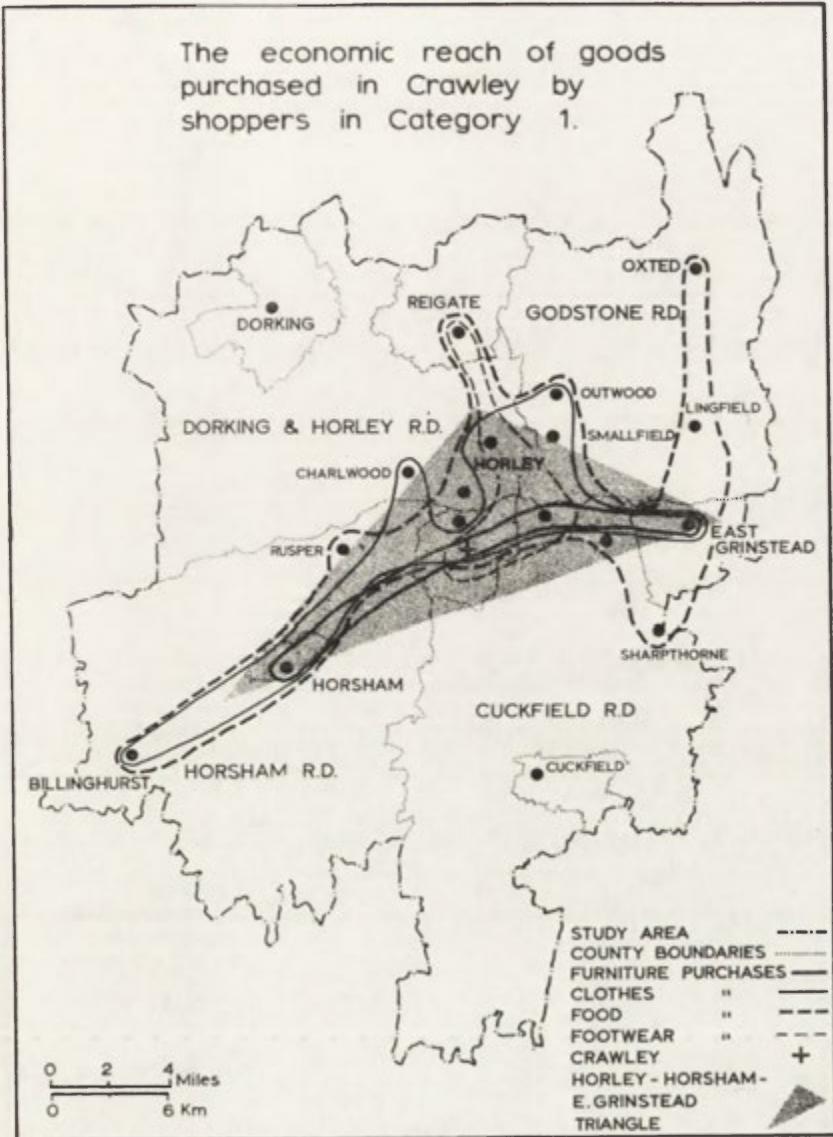


Fig. 4.

L. Bolwell. From tests carried out it is impossible to simulate the pattern using either a simple gravity allocation model, or even by using a modification such as that suggested by Lakshmanan and Hansen [10]. What is needed is a considerably more complex model. This must determine the attractiveness not only for each individual good, but also for each good by individual types

of consumer. If a model is to be further refined by taking into account trip frequency or expenditure per trip one is led to a situation where the model must disaggregate and reaggregate an almost infinite number of sub-sets.

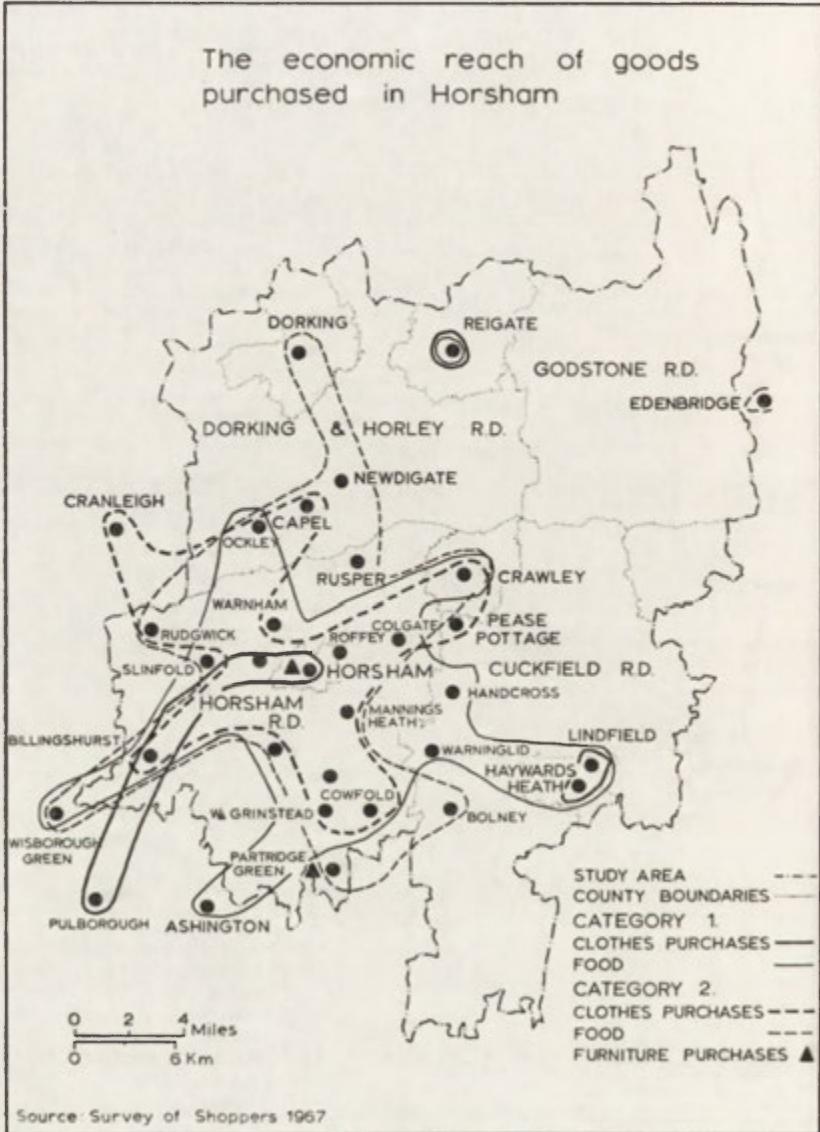


Fig. 5.

To illustrate this point it was found that shoppers of Socio-Economic Groups (SEG) 1, 2 and 4 (that is professional, managerial and clerical groups) were attracted to Crawley from a fairly small zone, approximately a triangular area between Horsham, East Grinstead and Crawley (Fig. 3). It was also found

that shoppers in the other Socio-Economic Groups came from a considerably larger area (Fig. 4). When this is compared with shoppers using Horsham (Fig. 5) it is to be noted not only that the shoppers of all groups tended to come from the same area, but that shoppers from Crawley were using Horsham centre in some numbers. A similar pattern was repeated elsewhere, although to a less marked degree.

Crawley is therefore involved in a series of complex retail relationships with its surrounding area, relationships which have tended to act to reduce the predicted retail impact of the New Town. Its attractiveness is limited to a marked degree, not by spatial barriers, although some distance-decay function is involved, but by social or perceptual barriers. It has great attraction to certain socio-economic groups but not to others. Data from further surveys would suggest that never migrants to its rural surrounding area are more likely to use the retail facilities of Crawley than pre-New Town residents. This may be a function of knowledge of the retail opportunities, the age of shoppers or of the image of Crawley as a centre. It does not reflect either the range of goods provided or their prices, since these tend to be fairly constant throughout. Whether in the light of major new retail developments in Crawley this differential impact remains static in the future is open to question. There are grounds for suggesting, however, that at this time the whole area is functioning as a dispersed retail zone. Different centres are satisfying different retail demands, demands associated as much with the quality and type of town centre environment as with the goods provided.

At this point it may be of interest to note briefly that families using Crawley town centre on a regular basis consistently under-estimated the time and distance involved in travelling to it. The reverse was true of those using other centres.

Crawley provides other services for both its urban population and the surrounding areas. These range from retail services (such as milk deliveries and travelling shops) to organisational facilities (such as clubs and voluntary organizations), to official services (such as sewage, posts and telecommunications) and to local government facilities (such as an indoor swimming pool). It has been estimated that up to 45% of the users of the swimming pool come from outside the town. Some embarrassment was caused at a presentation to the one-millionth user of the pool. The recipient not only came from outside Crawley, but was a resident of East Sussex. This reinforced complaints that, although Crawley U. D. and West Sussex County Council had provided the finance for the facility, its location at the periphery of the country administrative area ensured that much of its use would be by non-residents and non-ratepayers. Although perhaps a slightly flippant example, this case does typify one problem of the local urban-rural relationships of the area. More will be said about this later.

A further functional relationship only partly involving movement may now be noted. Rural areas surrounding Crawley exist not only as a place of work or residence for their own inhabitants but also provide an environmental asset for the residents of Crawley. They provide open spaces, recreation, and other facilities that may all be summed up as "greenness". They are, in fact, resources for a population from a considerable area. This relationship may be passive in that such resources act as a type of insurance policy. They are known to be present even if not used regularly by all. The relationship may also be active, however, as reflected in the high use of rural pathways and roads during the summer, especially at weekends.

## POLITICAL RELATIONSHIPS

Relationships so far considered have been spatially and socially orientated. That is to say the actual movement of persons or objects between the rural and urban areas have been considered. These have been treated in an essentially descriptive way, since their complexity makes the construction of any type of interaction model difficult. A further series of relationships exists, however. With these a more conceptual analysis may be attempted.

Crawley is a rapidly-growing centre. The 63,000 persons resident in 1966 can be expected to increase to 70-75,000 persons by 1971. When future growth prospects are linked to the likely development of Gatwick Airport the population of the town could reach, or exceed, 120,000 persons by the year 2,000. This will involve the construction of new homes, factories, roads and all necessary urban facilities. It will involve the development of new urban areas beyond the existing urban boundary. Since at present urban land-use coincides quite closely with the Crawley Urban District boundary much future development will need to take place in neighbouring local government areas. Where exactly such growth will take place depends upon a series of factors. Economics, resource utilisation and space-users', preference all play parts. In addition, land-use planning controls must be taken into account.

The process of urban development is one which has received, and is receiving, considerable study. Various models have been suggested. These range from the descriptive to those involving considerable mathematical complexity. It is obvious that urban areas develop peripherally. Models such as those developed by Alonso [1] or Wingo [18] suggest that this growth reflects changing economic conditions. For example, if commuting costs fall, or if disposable income rises, new development will take place beyond the existing urban area. Such models do not, however, take into account social preferences and are therefore not directionally specific.

Urban development may be simulated stochastically using fairly simple parameters, such as distance from employment, access to open space, the availability of services and so forth. Such models, however, also assume that the market is the major determinant of development. Other models have been suggested in which other criteria are involved. Some form of welfare maximisation or minimum-cost factor is involved. Into such categories may fall such models as those suggested by Schlager [15], or modifications of the Lowry model [11], as proposed, using a gravity allocation base, by Cripps and Foot [5] or Hill [9], or welfare models, as suggested by H. Ben-Schahar [2]. Such models need sub-models to provide essential supply or demand parameters so that these can be equated in some equitable or efficient manner. In fact they locate urban development in relation to some development goal or objective. In most cases this has been to minimise journey to work. Although such trips are the dominant type of urban movement and although the community incurs a high cost in the provision of communications, it is difficult to justify such dominance, except, perhaps, for computational ease.

Reflecting North American origin, the models considered so far severely limit the role of land-use planning in urban development. In most cases, if planning is assessed at all, it is assumed to operate in some random way and is therefore usually simulated stochastically. Such a model is that suggested by Drewett [7]. However, in a situation where land development is a function of a land-use planning process the importance of this process can hardly be over-emphasised. Such a statement receives even greater emphasis where land demand has exceeded land supply for some period. This situation has been in

existence in the South East of England for the past two decades. Whilst it is true that land-use controls may appear to act in some random fashion, they are nevertheless a function of the administrative framework of land-use planning. It may also be that the parameters necessary to understand the process have not been investigated fully. Such randomness is not usually true in the cases of major decisions. Decisions made here are a practicable end-product of relationships between supply and demand on the one hand and the planning and political processes on the other.

Models have been suggested by Friend and Jessop [8] and by Wilson *et al.* [17] which conceptualise the operation of such processes. These are of considerable interest to the geographer. Although they tend to divorce the processes considered from the development process itself, they do provide a basis for the development of relationship sub-models.

Thus economic social pressures, planning processes and political decision processes are all inter-related.

Important in such a framework are the linkages between development pressures and political reactions, and between feasible solutions (i.e. those which satisfy either technical or political criteria) and development pressures. Of prime importance are the relationships involved within the political and decision-making process itself. The political decision is the prime controller, since within the democratic situation planning can operate only to prevent unwanted development, not to ensure where development will take place. This semantic difference is not relevant where demand is equal to, or greater than, supply.

What then are the factors affecting the political aspects and decision making of the development decision, and how may the analysis of relationships near Crawley prove useful? A model has been suggested by S. J. Rogers [13] which relates agricultural policy to what the author terms "Political Algebra". Such a model may be modified for use in considering urban expansion. Instead of:

$$A = f(N, C, Pu_{(t-tv)} \dots (tv)E_{(t)}, E_{(tt)}, O, D, R, I),$$

where:

- A = The possible action
- f = Some functional relationship
- N = A national emergency index
- C = The cost to the Treasury
- $Pu_{(t-tv)}$  = The need to preserve Parliamentary unity
- E = The attitude of the electorate and of world opinion
- O = The offensiveness of any particular solution to pressure groups
- D = The difficulty of carrying out any solution
- R = The rightness of any solution, i.e. how well does the solution satisfy the social/economic goals
- I = A function of inadequate analysis, and absence of individual objectivity

one could hypothesise that urban development is some function of:

$$A = f(C, Pu_{(t-tv)}, E_{(t)}, E_{(tt)}, O, D, R, I),$$

where the notation should now read:

- A = The possible planning decision
- f = Some functional relationship
- C = The cost to local and national finance

- $Pu_{(t-tv)}$  = The need to preserve local political unity  
 $E_{(t) (tt)}$  = The attitude of the local and national electorate  
 $O$  = The offensiveness of any particular solution the pressure groups  
 $D$  = The administrative difficulty of carrying out any political solution  
 $R$  = The rightness of the solution  
 $I$  = Some function of inadequate analysis

Whereas Rogers was considering the national situation, it must be remembered that at the local level one is dealing with a series of political organisations and pressure groups. These may well be operating at the Urban or Rural District level, the county level, and at the regional or national level. The model should, therefore, be further modified to summate the relationships at these different administrative levels.

A brief survey of the situation in relation to Crawley may now be attempted in the light of such a framework. Administratively Crawley U.D. lies at the periphery of jurisdiction of West Sussex County Council. It is bounded by Horsham R. D., also in West Sussex, Dorking and Horley R. D. and Godstone R. D., in Surrey, and Cuckfield R. D., in East Sussex. Thus there are linkages at similar levels and between the different administrative levels. Politically, until recently Crawley was controlled by a Labour Council, the remaining areas by Conservative ones. In addition, relationships are further complicated by the presence of the Commission for New Towns and by the British Airports Authority.

Since the lowest level at which major development decisions may be made is at the County Council level, it is the relationships at this level which are of importance. Although Crawley is part of West Sussex and is the largest urban centre in the county, its voice is challenged by the presence of councillors from rural areas within the remainder of the county. All surrounding rural areas, with the exception of Horsham, look to their respective County authorities. For various reasons the respective County Councils tend to be antagonistic towards Crawley. The future development of the town would involve the loss of the county area. Crawley itself would, of course, approve of this, since an increased population and area would give increasing autonomy. Larger numbers of urban dwellers within a county could change its political composition. Services needed elsewhere within the county would also be demanded by any rapidly-developing urban area.

Pressure groups within the surrounding areas also tend to be antagonistic. They may operate within or outside the local democratic situation. Such pressure groups arise from existing residents of the rural areas. These fall into two groups. The first consists of those who lived in the area before the development of the New Town. Farming and business interests might be argued as being characteristic of this group. Although there is little doubt that farmers could obtain high prices for their land where farming is regarded as a way of life rather than simply of income, many would be unwilling to sell, as urban expansion would thereby involve a loss of livelihood. Business interests in nearby market centres are also antagonistic. The further development of Crawley as a centre will, it is felt, adversely affect their trade, even if past experience leads one to doubt this. In the second group there are those who have preferred from choice to live within the rural areas. These have usually done so in order to enjoy the available "rural amenities" and urban encroachment would destroy these. Such groups provide many local and county councillors.

Relationships between Crawley and its surrounding rural area therefore tend to be extremely antagonistic. Since in essence it is the external rural areas who control the future allocation of land for urban development, it is possible to see why extreme conflict arises. Such conflict is a reflection of the perception of the situation, i.e. whether the perceiver is "looking in" or "looking out", and reflects a general fear of a new vigorous immigrant community, to which many of the rural population areas do not look for work or services. The conflict is waged at both technical and political levels, and at present it seems that some type of stalemate may have been arrived at. Should the recommendations of the Royal Commission on Local Government in England ever be implemented for this area, such conflict is unlikely to be resolved. It is proposed that Crawley would be incorporated in southern Surrey; therefore Crawley would still be peripheral to an administrative area, with little scope for further development within that new area.

## CONCLUSION

This paper has attempted to describe and analyse the complicated spatial relationships existing between Crawley and its surrounding rural area. The impact of this major new centre has been considerable, not only as regards explicit geographical relationships (such as shopping and journey-to-work movements), but also as regards the polarisation of political attitudes which Crawley's coming into being and further development have created. The systematic study of political relationships is sometimes overlooked in urban-rural problems, but it can often help us to understand some of the factors controlling the intrusion of urban development and influence into rural areas. It remains to be seen whether in time Crawley will attain a more harmonious and integrated relationship with its surrounding rural area.

University of East Anglia

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## URBAN AND RURAL RETAIL STRUCTURES IN THE EAST MIDLAND REGION OF ENGLAND

JOHN A. DAWSON

### THE AIMS OF THE STUDY

Many recent studies in retail geography have been concerned with the relationships of central place theory to the retail distribution of goods.<sup>1</sup> The central place has been viewed as a collection of retail and service outlets and the complexity of the retail economy has been studied in terms of the range of goods, transport costs, and hierarchically-determined patterns of consumer travel. This preoccupation with central place theory has resulted in far less intensive study of other areas of retail geography.<sup>2</sup> Some important topics in retail geography have received scant attention, in particular the analysis of the spatial structure of shop size, the growth and development of different types of retailing and, most notable of all, the economic structure and relationships of groups of retail firms which form urban and rural retail economies. Central place theory argues the existence of hierarchies, which are groups of places defined in terms of measures of size of service provision in a town or village economy.<sup>3</sup> No comparable theory is available to deal with variations in shop size, in organization of retail trade, in retail productivity, in retail margins, and in the many other elements which make up the retail

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<sup>1</sup> Many studies relating central place studies to retailing theory exist. Major bibliographies are included in B. J. L. Berry and A. Pred, *Central place studies — a bibliography of theory and applications*, 1961 and *Suppl.* 1965; M. Palomaki, *The functional centres and areas of S. Bothnia, Finland, Fennia*, 78 (1964); B. J. L. Berry, *Geography of market centres and retail distribution*, 1967.

<sup>2</sup> The comparative lack of research in topics other than central place theory is shown in P. Scott, *Geography and retailing*, 1970. Consumer behaviour, however, has received some attention, notably in G. Rushton, R. Golledge; W. A. V. Clark, *Formulation and test of a normative model for the spatial allocation of grocery expenditures by a dispersed population*, *Ann. Ass. Amer. Geogr.*, 57(1967), 389-400.

<sup>3</sup> Studies of hierarchies inevitably concentrate on aspects of size of economy. See, for example, P. L. Fano, *Organisation, city size distributions and central places*, *Pap. Reg. Sci. Ass.*, 22(1969); J. B. Kenyon, *On the relationship between central functions and the size of place*, *Ann. Ass. Amer. Geogr.*, 57(1967), 736-756; B. J. L. Berry, *op. cit.*, especially pp. 26-42.

system.<sup>4</sup> Whilst empirical studies suggest the presence of a retail hierarchy it is also possible to determine groups of settlements in which retailing shows common *economic* characteristics. The urban taxonomies of Harris,<sup>5</sup> Nelson,<sup>6</sup> and Moser and Scott<sup>7</sup> provide one philosophy of town groups, whilst the urban hierarchies of Christaller<sup>8</sup> and Smailes<sup>9</sup> provide a second; however, the two need not be divorced to the extent they have been.

The aim of this paper is twofold: firstly to present a method of defining groups of districts which have similar retail character, and secondly to indicate some results of a preliminary study into the retail economies of urban and rural areas in the East Midland region of England (officially known as the North Midland region until 1965). The problem is to define groups of administrative areas with a similar basic retail structure. Administrative areas have to be used because the available data are collected on this basis but this is not necessarily a disadvantage, because the administrative unit is inevitably an economic and political entity to a large extent. Thus the economy of an area is inextricably bound up with its political administration.<sup>10</sup> Land-use planning by local government authorities and economic planning by large firms are carried out within the framework of administrative areas.<sup>11</sup> The administrative areas used in the study are of two main types: towns with official urban status and Rural Districts. However, the official towns may include quite large areas of rural land, while conversely a Rural District may include several large villages (some with mining, manufacturing or dormitory functions) and even small towns of 4–5,000 people. Thus there are problems in using administrative units in a study such as this, but it is not feasible to use other areal units.

#### METHOD OF THE STUDY

Two approaches to the measurement and comparison of retail structure have been developed. Firstly, the structure within the retail economy of an area may be studied. For example, analyses of the size-distribution of shops

<sup>4</sup> Some economic relationships are discussed in W. G. McClelland, *Costs and competition in retailing*, 1966 and Idem, *Studies in retailing*, 1963.

<sup>5</sup> C. D. Harris, A functional classification of cities in the U.S.A., *Geogr. Rev.*, 33(1943), 86–99.

<sup>6</sup> H. J. Nelson, A service classification of American cities, *Econ. Geogr.*, 31(1955), 189–210.

<sup>7</sup> C. A. Moser and W. Scott, *British towns: a statistical study of their social and economic differences*, 1961.

<sup>8</sup> W. Christaller, *Central places in Southern Germany*, 1966.

<sup>9</sup> A. E. Smailes, The urban hierarchy in England and Wales, *Geography*, 39(1944), 41–54.

<sup>10</sup> Studies of political and economic interaction in administrative areas in England are absent from the literature. Examples from the U.S.A. are abundant and several are discussed in R. W. Bahl, *Metropolitan city expenditures*, 1969. See also J. Alt, Some social and political correlates of County Borough expenditures, *Brit. J. Polit. Sci.*, 1(1971), 49–62.

<sup>11</sup> Whilst economic and political variables may be related successfully to administrative areas, the social variables present a much more complex pattern. It is the use of administrative units to determine social groupings which may be criticised from the standpoint of unrelated basic units. Some problems are discussed in B. Robson, *Urban analysis*, 1969.

and the various ratio measures related to this distribution are of this type. The comparison of areas and the grouping of areas can then take place by reference to the different size-distributions. This method works well for towns, but the size distribution of shops in a Rural District has less meaning and describes somewhat different features of a retail economy. The second method is simpler and involves ratio measures (such as sales per shop, sales per employee, and wages as a percentage of sales) averaged for all shops within each administrative unit. The areas may then be grouped on the basis of a comparison of the average values. For each group of places it is possible to study relationships amongst variables and these relationships may also be compared over the groups. The form of the data available for the East Midlands forces the use of the second approach in this study. In other areas, for example Eire, where more detailed censuses of distribution are available, both types of study are possible. The somewhat limited data for Great Britain preclude studies of size-distributions, even at the urban level.

The ratio measures used in this study of the East Midland region are calculated from the Census of Distribution for 1961, the latest complete census available, and they relate to 131 administrative units in the region.<sup>12</sup> Seven variables are calculated for each unit. The variables are the values for sales per shop, employees per shop, sales per employee, percentage of part-time employees, population per shop, retail sales per person, and retail employment as a percentage of total population. In all the employee-measures two part-time employees are considered as equivalent to one full-time employee. The first two variables provide an indication of the scale of retail enterprise in the area, the second pair measure productivity and employee use, and the final three are crude measures of shop provision, demand for shops, and the importance of the retail sector as an employer. It is appreciated that all these measures are very general, especially the last three of them. As more data on the retail sector become available so more sophisticated measures may be used, and at these future stages hypotheses or theories may be tested. The present level of analysis allows only description of the elements of the retail system. Conclusions and comparisons can be drawn but they cannot, as yet, provide the basis for sound hypotheses and explanations of retail processes. The seven variables used in this study are valuable at the present preliminary stage of enquiries. The method used is applicable even if more variables are included.

The methods used to classify the 131 areas into groups in respect of the seven variables are those of principal component analysis, with subsequent grouping of the component values on the areas by a cluster analysis technique. To define relationships within each of the groups correlation and regression analysis are used. The basis of the method is the clustering technique, for on this depends the membership of the groups. A number of clustering techniques are available.<sup>13</sup> The method chosen is one of the simplest, but it requires that the items to be grouped are measured on orthogonal variables. The easiest way to transform the seven data variables to orthogonal form is by principal component analysis. Principal component analysis has gained acceptance by sta-

<sup>12</sup> Board of Trade, *Census of distribution and other services*, 1961 (1964).

<sup>13</sup> Several are discussed in R. C. Tryon and D. E. Bailey, *Cluster analysis*, 1970 and R. R. Sokal and P. H. A. Sneath, *Principles of numerical taxonomy*, 1963. Geographical examples are provided in B. J. L. Berry, *Grouping and regionalising: an approach to the problem using multivariate analysis*, in W. L. Garrison (ed.), *Quantitative geography*, 1967.

tisticians as a valid method for the analysis of certain types of multivariate data.<sup>14</sup> Its validity for the analysis of other types of data may be questioned.<sup>15</sup> In its usual form the analysis involves the factorisation of a Pearson product moment ( $r$  value) correlation matrix which interrelates the variables. Mutually uncorrelated, and therefore orthogonal, components are extracted from this matrix, and these may then be treated as new variables, each of which is composed of a mixture of old variables. The loadings on the components indicate the precise form of this mixture. In the extraction of the components the first one is so composed as to combine, linearly, as much as possible of the total variation in the data; the second component repeats the procedure for the remaining variance; the third and subsequent ones follow this same procedure. The amount of variance accounted for by the components is measured by the eigenvalues. The total eigenvalue is the number of input variables; thus if any component has an eigenvalue greater than 1 it is statistically explaining more of the total variance than a single original data-variable. By a study of eigenvalues and component loadings the composition and importance of the components may be determined. The components may be treated as new variables and thus each component has an area score in similar fashion to the original variables. The basis of the derived components is the intervariable correlation matrix. There is no conceptual reason why forms of correlation other than  $r$  values should not be used in principal component analysis.

The purpose of using principal component analysis for the present study is to reduce the data matrix to orthogonal components which account for as much as possible of the total variance. The aim is to achieve a maximum eigenvalue summed over significant components. If this maximum can be obtained by using a correlation technique other than  $r$  values, then certainly it is valid to use the alternative correlation method. In other uses of the method for different ends there may well be good reason for using  $r$  values.<sup>16</sup> In general there is still much work to be done on the validity of principal component methods in the analysis of different types of geographical data.<sup>17</sup>

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<sup>14</sup> Clear summaries of the statistical procedures of component analysis are provided by D. N. Lawley and A. E. Maxwell, *Factor analysis as a statistical method*, 1963 and K. Hope, *Methods of multivariate analysis*, 1968, 40–67.

<sup>15</sup> The discussion after the paper by W. K. D. Davies, Patterns of urbanisation in the Greater Swansea area, and reported in *Processes and patterns of urbanisation*, 1969 (Report of the Keele conference of the Urban Study Group of the I. B. G.) lays out some of the problems encountered by geographers in the use of principal component methods. Use of multivariate methods on univariate data, such as flow or transaction matrices, needs considerable exploration before the method becomes generally applied. See, for example, J. B. Goddard, Functional regions within the city centre: a study by factor analysis of taxi flows in Central London, *Trans. Inst. Brit. Geogr.*, 49(1970), 161–182.

<sup>16</sup> In using data related to areas further problems of correlation arise. See, for examples, A. H. Robinson, The necessity of weighting values in correlation analysis of areal data, *Ann. Ass. Amer. Geogr.*, 46(1956), 233–236; E. N. Thomas and D. L. Anderson, Additional comments on weighting values in correlation analysis of areal data, *Ann. Ass. Amer. Geogr.*, 55(1965), 492–505; G. E. Gehlke and K. Biehl, Certain effects of grouping upon the size of the correlation coefficient in census tract material, *J. Amer. Statist. Ass.*, 29(1934), 169–170; J. A. Dawson, A scale problem in the definition of multifactor regions; *Tijdschr. Econ. Soc. Geogr.*, 61(1970), 207–214.

<sup>17</sup> In respect of some of these problems applied to data in physical geography

## DEFINITION OF GROUPS OF AREAS

The principal component analysis applied to the 131 scores on 7 variables produce, with several correlation techniques, two major components. The eigenvalues scores are shown in Table 1. Four different correlation measures were tested and eigenvalues on both components 1 and 2 were highest when Spearman's  $\rho$  was used.<sup>18</sup> Use of Kendall's  $\tau$  produces drastically lower eigen-

TABLE 1. Eigenvalue scores for different correlation statistics

	$r$	partial $r^1$	$\rho$	$\tau$
Component 1	3.96	4.00	4.11	3.45
2	1.39	1.33	1.45	1.36

<sup>1</sup> Partial correlation  $r$  values with total population fixed.

TABLE 2. Composition of components in terms of original seven variables

Component 1				
	$r$	partial $r^1$	$\rho$	$\tau$
Sales per shop	.791	.788	.772	.670
Employees per shop	.843	.846	.836	.727
Sales per employee	.103	.059	.055	.043
Part-time employees (%)	.435	.468	.403	.332
Population per shop	.805	.812	.870	.805
Sales per person	.951	.949	.976	.927
Employment % population	.935	.937	.967	.923
Component 2				
	$r$	partial $r^1$	$\rho$	$\tau$
Sales per shop	.538	.533	.561	.594
Employees per shop	.263	.209	.275	.378
Sales per employee	.800	.841	.805	.698
Part-time employees (%)	.519	.456	.535	.463
Population per shop	.226	.172	.306	.340
Sales per person	.111	.095	.068	.109
Employment % population	.231	.216	.165	.189

<sup>1</sup> Partial correlation with total population fixed.

Negative values underlined

see P. M. Mather, *Analysis of some late Weichselian sediment from South Lancashire and their relation to glacial and fluvioglacial processes*, unpublished Ph. D. thesis, University of Nottingham, 1969.

<sup>18</sup> An analysis by the author of 15 variables of population structure over 87 trade areas in Denmark also resulted in Spearman's  $\rho$  providing the maximum significant eigenvalue score. The first 4 components accounted for 80% of the variance when  $\rho$  was used, but 74% when  $r$  correlations were used.

values on the first two factors. There would appear to be a case for using Spearman's  $\rho$  as the correlation technique in the present study.

The composition of the components in terms of the original seven variables is shown in Table 2. The general problem of significance levels in principal component analysis is unresolved.<sup>19</sup> Whilst it is convenient to visualise the component loadings as similar to correlation measures, they are in reality the data-variable coefficients of the straight-line equation of the particular component. In Table 2 the loadings are very similar whichever correlation technique is used. The small differences in the loadings produce the quite large variation in eigenvalues. The two shop-size measures, i.e. sales per shop and employees per shop, load heavily on component 1, as do the final three variables which measure the size of the retail economy. The two productivity measures load heavily on component 2. In very general terms an interpretation of the two components could be that the first relates to shop scale and the second to shop productivity. Interpretation of components in this form of analysis is a statistically and conceptually suspect operation, as the analysis produces, by definition, mathematical variables not geographical ones. The factor analysis model presents a better approach if meaningful super-variables are to be determined.<sup>20</sup> The present study does not rest on an interpretation of the components; the components are used solely in the definition of groups of administrative units.

The component loadings of the analyses based on  $\tau$  and  $\rho$  values do not differ greatly. The eigenvalue for the analysis using  $\rho$  is somewhat larger. The components obtained from the matrix of  $\rho$  values have been used for the remainder of the analysis.

The weightings of each area on the components are the data which are clustered. The cluster analysis technique is that outlined by Mather.<sup>21</sup> The orthogonal components are considered as axes of an Euclidean space and the values for the areas can be plotted in this space. By measuring distances between pairs of areas plotted within this space the most similar places are considered as those closest together. The two closest scores are then considered as one score at the centroid of the two values. Thus a *proto-cluster* is formed, and the procedure is repeated until an optimum cluster pattern is obtained. Doubt exists on the definition of optimality in this and other clustering techniques.<sup>22</sup> The method here used is that of Holzinger.<sup>23</sup> It is probable that the use of other methods would give only a slight difference in the final membership of the groups. Other forms of clustering and methods of defining optimality

<sup>19</sup> Similarity of component scores with correlation coefficients is suggested in W. Isard, *Methods of regional analysis*, 1960, 302-304, but this is not a generally accepted view. Work on significance testing in factor analysis is shown in M. S. Bartlett, Tests of significance in factor analysis, *Brit. J. Statist. Psychol.*, 3(1950), 77-85, and Idem, A further note on tests of significance in factor analysis, *Brit. J. Statist. Psychol.*, 4(1951), 1-2. Significance tests were also carried out by P. M. Mather *op. cit.*

<sup>20</sup> H. Harman, *Modern factor analysis*, 1969.

<sup>21</sup> P. M. Mather, Cluster analysis, *Computer Application in the Natural and Social Sciences* 1, Nottingham 1969.

<sup>22</sup> J. J. Fortier and H. Soloman, Clustering procedures, in: P. R. Krishnaiah (ed.), *Multivariate analysis*, 1966.

<sup>23</sup> K. J. Holzinger and H. H. Harman, *Factor analysis*, 1941. The presence of a 95% significance level grouping in 100 areas with 10 variables is noted if the Holzinger *B* figure, a measure of inter-to-intra-group distance, is greater than 1.5.

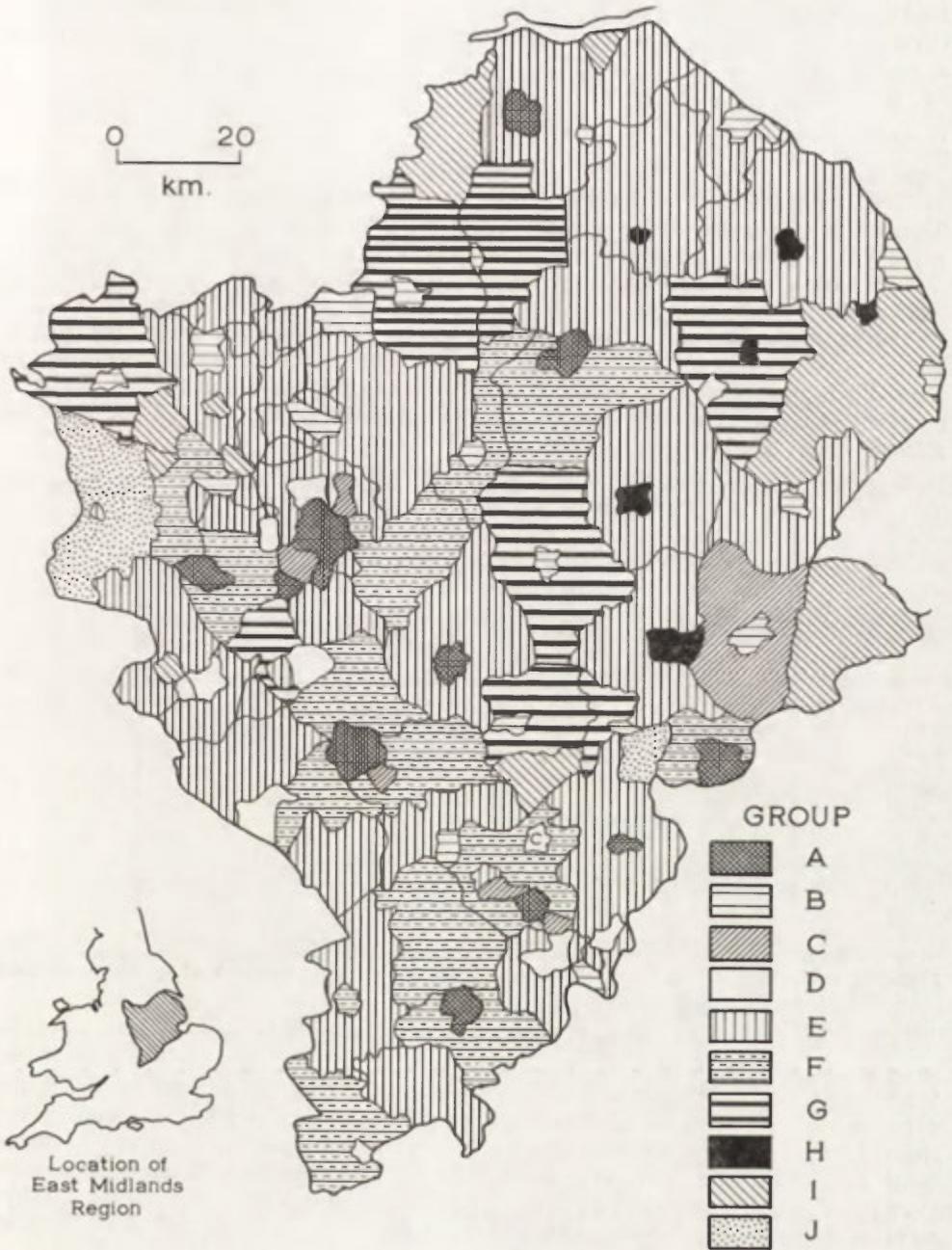


Fig. 1. Administrative areas in the East Midlands according to cluster-analysis groups

involve both more complex theory and longer calculation than those used by Mather and Holzinger. The relatively simple concepts of the cluster method make it easy to apply, and the presence of only two components simplifies it even further, for the statistical procedures may be carried out in two-dimensional space.

#### MEMBERSHIP OF THE GROUPS

Ten groups of administrative units are defined by the cluster analyses.<sup>24</sup> These groups are shown in Figure 1. In addition to the 10 groups one unique place exists which does not join with any other group. The place is Corby, a New Town, which has a very distinctive retail economy composed of very large shop units which have developed within a totally-planned environment.<sup>25</sup> Of the ten groups one contains only two areas, and this does not allow further analysis. The two areas are both Rural Districts and have very small figures for sales per shop despite very large figures for population per shop. Thus in both areas there is a very low level of retail activity. Of the ten groups nine allow further analysis.

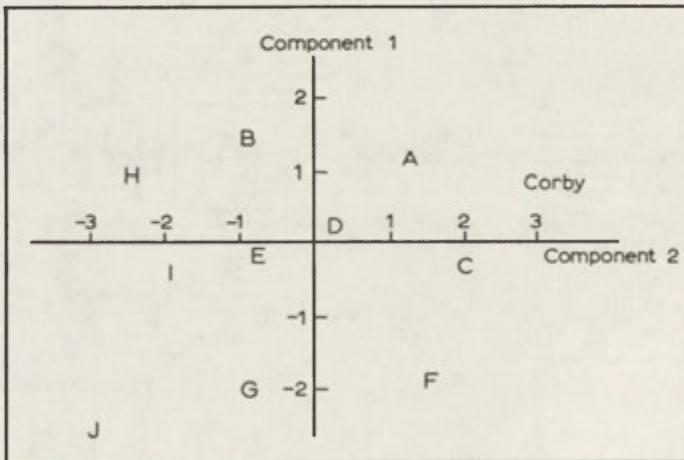


Fig. 2. Position of the groups of administrative areas in respect of component axes

The nine groups consist of four groups composed solely of towns, two groups composed of Rural Districts, and the remaining three groups are a mixture of towns and Rural Districts. The largest group (E) of 40 administrative units consists of both towns and Rural Districts. Thus on the measures considered there is more similarity between some urban and rural areas than between some pairs of towns or some pairs of Rural Districts. Group E contains a wide variety of political units, with areas from both industrial North-east Derbyshire and agricultural North Lincolnshire. There is little spatial contiguity of

<sup>24</sup> A B value of 1.8 was calculated for this grouping.

<sup>25</sup> K. C. Edwards, Corby — a new town in the Midlands, *Town Plann. Rev.*, 22(1951) and D.C.D. Pocock, *An urban geography of selected steel towns*, unpublished Ph. D. thesis, University of Nottingham (1967) discuss the origin and development of the town.

membership of this group. In general there appear to be few if any spatially-defined sub-regions of distinct retail structure. Group A, with twelve members, contains some of the largest towns in the region, including Nottingham, Derby, Leicester, Northampton, Peterborough and Lincoln. The relationship of the groups to the components is shown in Fig. 2. The two axes represent the two components and the centroids of the clusters are shown. Group A shows a positive score on both axes. Thus, using the very general interpretation of the components, the towns of group A have large-scale retailing which also has high productivity. More detailed discussion of the retail structure of the groups is provided below by regression and correlation analyses. The urban and rural units comprising group B show wide variety, with the holiday resort of Skegness on the East coast included alongside industrial Chesterfield in North-east Derbyshire and the market town and port of Boston in South Lincolnshire. Despite these differences in economic function the retail economies of these towns indicate a marked degree of similarity. Group C contains only eight places; seven towns and one Rural District. Several of the Urban Districts are suburban in character, notably Arnold, and Beeston and Stapleford, near Nottingham, and Oadby, south of Leicester. Group H is even smaller, with only six members, all of them towns in East Lincolnshire. Although they constitute only a small group, membership is limited to a small sub-region. On the diagram of cluster centroids the Groups A, B, D and H are composed of towns and all have positive values on component 1. The groups G, F, and J are composed of Rural Districts. A remarkable feature of membership of all these groups is their general lack of spatial contiguity, as shown in Fig. 1. The remaining group I, with both types of administrative units as members, shows four towns in North Derbyshire, viz. Matlock, Wirksworth, Clay Cross and Alfreton. Matlock Urban District includes a series of small centres within one administrative unit. There could be in this area a sub-regional retail economy. The evidence, however, is very slight. Membership of the groups of administrative units shows wide variation, with both towns and rural areas within the same group.

#### ANALYSIS OF THE GROUPS

Differences amongst the groups may be seen in terms of the component scores and also in terms of the original data. The position of the cluster centroids has been mentioned above. The structures in the groups in respect of the original data may be analysed by correlation and regression techniques. To investigate relationships over the series of groups linear regressions of  $y = mx + c$  form have been calculated for pairs of variables which have a significant  $r$  value relationship.<sup>26</sup>

Three types of relationship are considered. The first series of relationships involve measures of total size of the retail economy, for example total number of shops, sales, employees, and population for each administrative unit. Correlations amongst these, of necessity, will be high. Administrative units with a large number of shops necessarily have large sales and large employee numbers.

<sup>26</sup> Significance levels were taken from R. A. Fisher and F. Yates, *Statistical tables for biological, agricultural and medical research* (1963), together with probable errors from K. Holzinger, *Tables of the probable error of the coefficient of correlation as found by the product moment method* (1925) and, for smaller samples, the tables in *Biometrika*, 11(1924), p. 379.

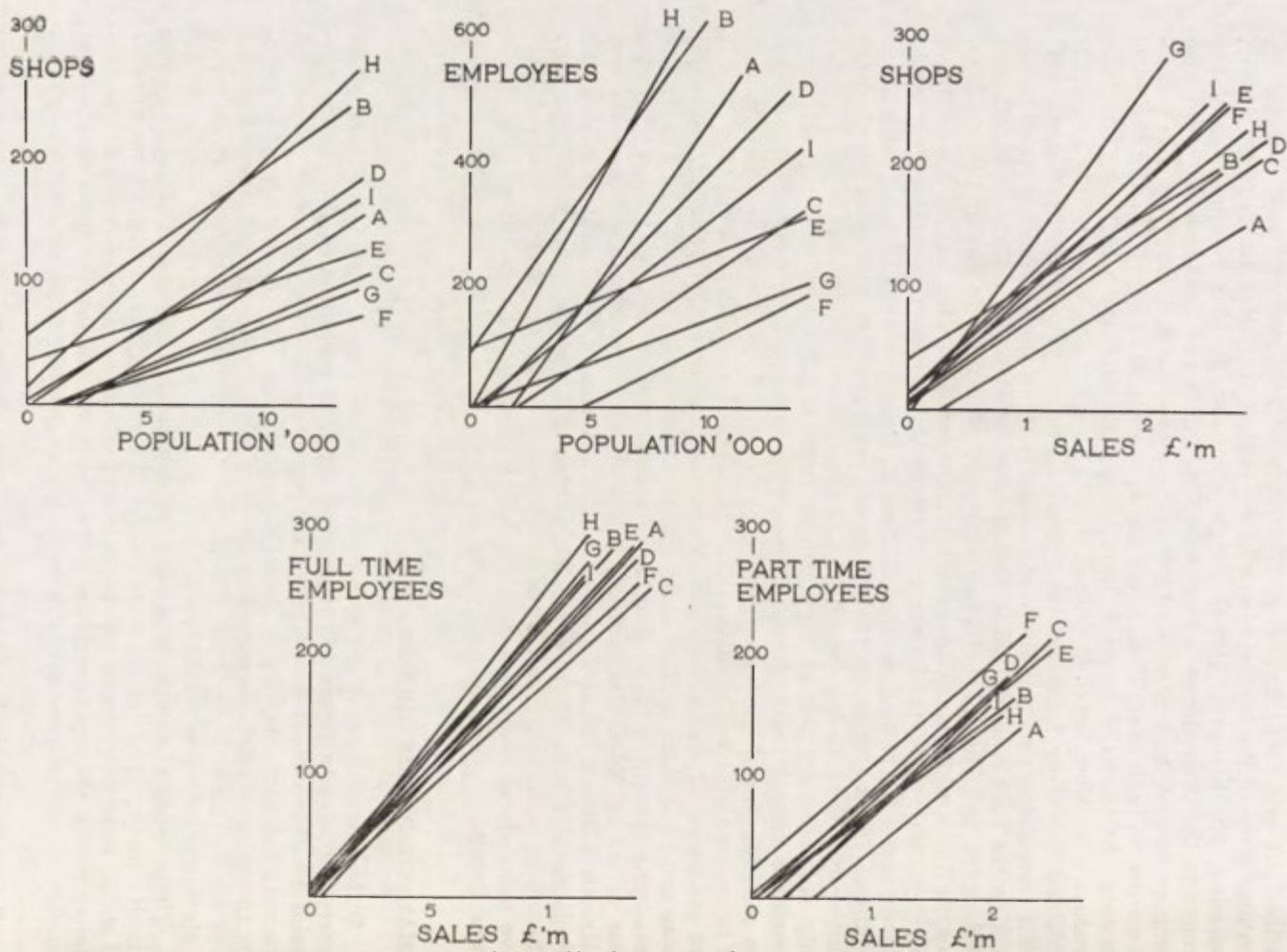


Fig. 3. Regression lines of retail-size variables for groups of administrative areas

Conversely a small number of shops has small total sales. In these relationships it is the regression relationship which is important. The regression equation describes the form of the relationship — the rate of change of one variable in terms of another. The second series of relationships involve the ratio measures, and with these both correlation and regression are important. A place with large sales per shop does not always have high sales per employee. By analysis of the significant relationships it is possible to define precisely certain aspects of the retail economy which exist in the groups of administrative units. These relationships may be the results of economic processes, for instance scale economies working in the group retail economy. To define processes, however, data over several years are necessary. Thirdly, relationships between measures of size and structure are studied. A full explanation of the groups may only be meaningful in terms of economic processes, but some observations can be made by reference to several of the regression relations for a single year.

TABLE 3. Regression equations

Group	Shops v. population	Employees v. population	Shops v. sales	Full-time employees v. sales	Part-time employees v. sales
A	$y = .014x - 30.0$	$y = .057x - 95.6$	$y = .059x - 15.4$	$y = .201x - 8.7$	$y = .083x - 42.0$
B	$y = .013x + 58.6$	$y = .056x + 85.4$	$y = .062x + 41.2$	$y = .221x + 4.5$	$y = .074x - 2.7$
C	$y = .008x - 8.7$	$y = .027x - 47.5$	$y = .074x + 3.0$	$y = .078x + 1.0$	$y = .107x - 25.2$
D	$y = .014x - 3.5$	$y = .042x - 29.5$	$y = .078x + 8.4$	$y = .198x - 8.7$	$y = .090x - 16.7$
E	$y = .006x + 36.8$	$y = .017x + 88.6$	$y = .095x + 3.6$	$y = .209x - .2$	$y = .082x + 5.0$
F	$y = .006x - 6.0$	$y = .016x - 49.0$	$y = .084x + 16.8$	$y = .179x + 11.8$	$y = .096x + 12.8$
G	$y = .007x - 7.9$	$y = .014x - 3.1$	$y = .138x - 4.4$	$y = .236x - 3.7$	$y = .093x - 2.6$
H	$y = .019x + 15.3$	$y = .071x - 4.6$	$y = .078x + 14.9$	$y = .257x - 4.3$	$y = .073x - 2.6$
I	$y = .012x + 3.4$	$y = .034x - 11.9$	$y = .095x + 13.0$	$y = .229x + 13.9$	$y = .098x - 28.8$

The regression lines for the first series of paired variables are plotted in Fig. 3. Table 3 shows the regression equations. In the five regressions considerable variety exists over the nine groups of places. The total number of employees calculated as dependent on population shows the greatest range of regression lines, and much smaller inter-group variation is shown with employee numbers dependent on sales.

The first regression shown in Fig. 3 and Table 3 is that of shop numbers dependent on population. The steepest regression line, with a gradient of 19 shops per thousand population, is that associated with the 6 towns of East Lincolnshire. The lowest gradient, of 6 shops per thousand people, is shown associated with the large group of 40 towns and Rural Districts, group E, and with group F, the 14 Rural Districts. It is not unexpected that shop provision is lower in the rural areas. Such is not always the case, however, since a very similar shop gradient results from comparison of group C with group G, although the former is essentially urban and the latter essentially rural. Thus either this group of rural areas has a particularly high shop-generating function or the urban areas have a particularly low one. The urban group C is the group containing suburban centres and thus it would seem that the low shop numbers are related to the suburban function of these administrative units. The gradient is but one element in the regression line; the total shop size for a given population is also dependent on the constant value, as seen in Fig. 3. The high constant

value for group B towns means that at the lower end of the population scale large numbers of shops are present. Group E shows this feature even more strongly, with a relatively large number of shops at a population-level of 5,000 but at the 10,000 level five of the other eight groups have more shops. These regression lines describe the situation at one moment and thus it is not valid to assume anything about changes in shop numbers as related to population growth. There is no reason to assume that the administrative units will move up or down the regression line as population changes. In terms of shop numbers dependent on population the groups of administrative units exhibit a wide range of relationships; for an administrative unit of 10,000 people the shop range lies from 50 to over 200, depending on the group to which it belongs, and amongst groups dominated by towns the range is from 70 to over 200 shops.

The second regression considered is that of employee numbers dependent on population. Over all the groups the employee figure ranges from 100 to 700 for an administrative unit of 10,000 people and for urban groups from 220 to 700. Once again groups H and B have very steep gradients. Almost equally as steep as group H's gradient is that of group A, composed of some of the large towns in the region. The gradient is 57 employees per thousand population. Thus, although shop numbers in towns of group A do not increase rapidly with population, the number of retail employees shows a steep regression gradient.

The third regression shows shop numbers dependent on sales. The relatively small number of shop units in the towns of group A is again indicated. The high sales per shop of this group is indicated by the centroid score in relation to the component axes (Fig. 2). A comparison of towns with large and small sales indicates that towns with larger sales have a relatively smaller shop size. In group B absolute sales per shop are lower than in group A and thus more shops are associated with a given sales volume, and again, in contrast, the shop size is larger when sales volume is larger. Thus the two groups show a very different type of shop-number response to total sales. A comparison of the shops against sales regression with that for shops against population is interesting, for group G has a very low shop-generation in respect of population but a very high one in respect of sales; thus it takes a relatively large number of people but only a small amount of sales to produce a shop. Group H shows a tendency for the opposite state of affairs and group C requires a relatively large number of people or a large total sales to result in the generation of a shop. By comparison of these relationships the differences amongst the groups can be shown to be very great — differences not only of scale but also of reaction to chosen independent variables.

The fourth regression involves the number of full-time employees related to the independent variable of sales. The values at the lower end of the scale are shown in Fig. 3. The six towns forming group H again show the steepest gradient, with almost 260 employees per £1M sales, and the town-dominated group C has the lowest gradient of 78 employees for a similar sales amount. The other groups, both rural and urban, lie between these end values. Of the two groups composed of Rural Districts group G has the second steepest gradient and group F has the second-shallowest gradient of all groups. For a sales figure of £1M there is a difference of over 50 employees as between the two groups. The graphs diverge for higher sales values. The two groups of Rural Districts would appear to be of very different type. The previous regression of shops against sales shows the groups as very different for large sales volumes but less so for lower sales. In the case of full-time employee numbers the difference is noticeable at the lower end of the scale as well as with large

sales volumes. More full-time employees are generated from sales in the Rural Districts of group G than in the towns constituting both groups A and B. Thus for a sales figure of £1M a place of group G has an expected 134 shops and 232 fulltime employees and corresponding figures for a centre in group A are 44 shops and 192 employees. The size and complexity of these differences between groups is suggestive of different economic processes at work but such a view cannot be adequately tested until figures for 1971 become available.

Numbers of part-time employees as dependent on sales shows less variety of regression gradient over the nine groups than is the case with other regressions. The regression constants, however, are particularly important. The use of part-time employees is most strongly developed in group F, a group of Rural Districts, and in group C if large places are considered. In group F full-time employee figures as generated from sales are low, so it appears that part-time employment is particularly important in this group of areas. The groups with the shallowest gradients and (for large places) the smallest absolute figures for part-time employment are A, B, and H. All three are composed exclusively of towns. Part-time employees as generated from sales volume appear less important in these places. The somewhat tight labour market of many of the towns in the East Midlands may result in potential employees taking full-time employment in secondary industry rather than being available for part-time employment in the retail trades. In order to test such a view further analyses in the East Midlands and other areas are necessary.<sup>27</sup> The shallow gradients are not general to all towns; some are members of groups with quite a steep gradient. The suburban towns in group C show this feature, with the steepest regression gradient of all the groups. The use of part-time labour in suburban areas could be a response to both the particular shopping characteristics of these areas (including very marked daily and weekly sales cycles) and the characteristics of the local population, such as the availability of a supply of part-time, usually female, labour. From the analysis of the regressions of the groups of places a different importance is placed on part-time employees as related to sales in different groups. The two groups composed of Rural Districts, together with the group containing some suburbs, show a greater use of part-time employees than the entirely urban groups.

The regressions discussed are only some of those it is possible to analyse. The interrelationships of the retail economy are immense and only a few are touched on in this paper. In the regressions considered, however, the groups of places show individual and distinct forms of relationship. In some instances rural areas and urban areas show very similar regression relationships, while in others the two environments differ considerably. The five sets of graphs in Figure 3 and the relationships in Table 3 all deal with variables concerned with overall size of the retail economy of the administrative unit. The average ratio measures have been mentioned by implication only. It is equally possible to analyse directly relationships between pairs of ratio measures.

Correlations amongst four ratio measures for each group are calculated. The measures are sales per shop, employees per shop, sales per employee and percentage of part-time employees. In groups C, G, and H no significant intercorrelations occur. In groups B and F, on the other hand, four of the possible six correlations are significant.

<sup>27</sup> The use of part-time employees also depends considerably on the organizational structure of retailing in town. Multiple traders, for example, have a high proportion of part-time employees, whilst Cooperative Societies depend on full-time employees.

The most commonly significant correlation is between sales per shop and employees per shop, and this occurs in five of the groups.<sup>28</sup> The regression lines are shown in Fig. 4. Of the five groups showing a relationship, two are groups of towns and one is a group of Rural Districts. Sales per shop is considered dependent on employee size. The steepest gradients are those of groups I and F and the shallowest are those of groups B and E. For an average of four employees per shop the sales per shop varies from £13,000 to £17,000.

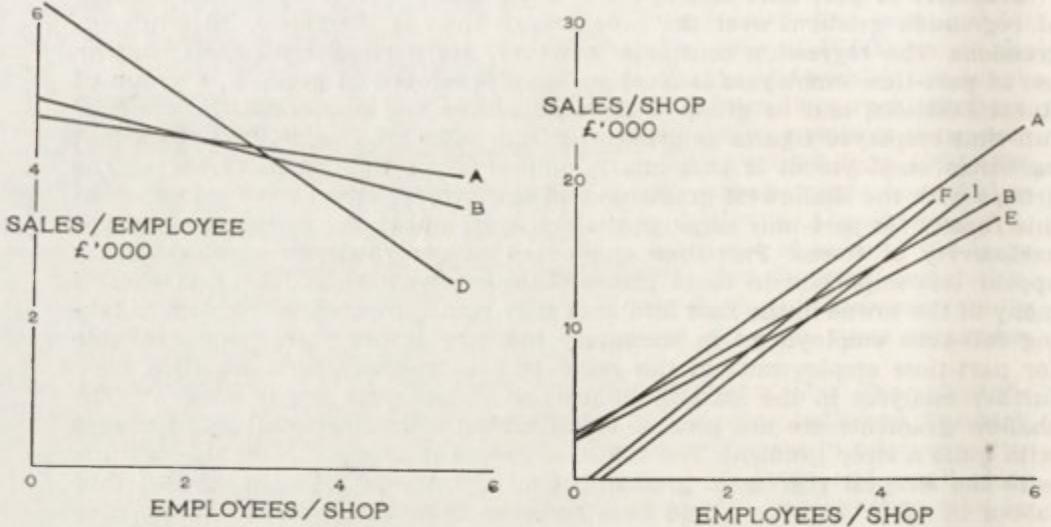


Fig. 4. Regression lines of retail-structure variables for groups of administrative areas

In groups A, B and D, all of which are groups of towns, sales per employee is negatively correlated with employees per shop.<sup>29</sup> The regression lines are shown in the lower part of Figure 4. Group D shows a steep gradient, with a productivity decrease of £760 per person associated with a unit increase of employees per shop. This value is over 3 times larger than that of the second steepest gradient. It appears that as division of labour increases, with more employees per shop, there is not a corresponding increase in sales per employee.<sup>30</sup> The three groups in which this relationship is evident are all groups

<sup>28</sup> The five equations are:

group	equation	r
A	$y = 3.51x + 2.69$	.98
B	$y = 3.07x + 2.75$	.92
E	$y = 3.46x + 1.37$	.89
F	$y = 4.44x - .73$	.59
I	$y = 4.19x - 1.54$	.95

(sales figures are in £'000)

<sup>29</sup> The three equations are:

group	equation	r
A	$y = -.171x + 4.88$	-.66
B	$y = -.264x + 4.81$	-.57
D	$y = -.761x + 6.38$	-.66

<sup>30</sup> With larger number of employees per shop jobs become more specialised and there is a large increase in non-sales personnel. Administrative and office staff

of towns. In groups F and I, a rural group and a mixed group, a positive relationship is indicated between sales per employee and sales per shop. Thus for these two groups, areas with large sales per shop also have high productivity and places with small shops have low productivity. This expected relationship is shown in only two of the nine groups.<sup>31</sup> A third correlation involving productivity is that between sales per employee and percentage of part-time employees. A significant correlation between these variables occurs in group D, a group of towns, and group F, a group of Rural Districts.<sup>32</sup> In both cases the correlation is negative; thus places with a high percentage of part-time employees show low figures for sales per employee. The gradients of productivity decline are £50 per unit percentage of part-time employees for group D and £78 for group F. The evidence is too limited to draw conclusions from these figures and similar analyses in other areas must be carried out before a difference between urban and rural groups may be hypothesised.

The relationship between the calculated ratio measures and the original measures of total size are very weak over all groups. Thus places with a large number of employees do not always have a large number of employees per shop or a large percentage of part-time employees. Only in groups B and F is there a correlation between ratio and size measures.<sup>33</sup> In both groups sales per shop is correlated with the total size measures. Thus only in these two groups do places with a large population or a large sales volume have large sales per shop, and places with small populations have small shops. In both cases the relationship is positive and significant at greater than 95% confidence level. Again, it is a group of towns and a group of Rural Districts which show the same feature of retail structure.

## CONCLUSIONS

A number of conclusions may be drawn from the analyses described above and also lines for future research may be seen. The main directions for future research on this topic appear to lie in both the general field of the applicability

increase with non-commensurate increase in sales. Such a position is seen in the results of two government surveys reported in Occupations in retail distribution: Great Britain, May 1967 *Ministry of Labour Gazette* (December 1967) and Department of Employment and Productivity, *Food retailing, Manpower studies* 8(1968).

<sup>31</sup> The regression forms in this paper have been considered simple linear. Transformation of the variables may result in additional correlations occurring, however; several curves, including logarithmic and hyperbolic, were fitted through the data in this case but these did not produce significantly larger correlation coefficients.

<sup>32</sup> The equations are:

group	equation	r
D	$y = -.051x + 4.98$	-.75
F	$y = -.078x + 5.87$	-.59

(sales figures are in £'000)

The economic relationship between part-time employees and productivity is discussed in K. D. George, *Productivity in distribution*, 1966 and W. B. Reddaway, *Effects of the selective employment tax, first report — the distributive trades*, 1970.

<sup>33</sup> The correlations are:

group B	.576
group F	.694

when employee totals are considered.

ity of multivariate statistical methods in geography and the specific field of better measurement of the retail economy. The development of significance tables for multivariate methods would be an important contribution in the first field. In addition, recent work on more sophisticated cluster analyses could well prove useful.<sup>34</sup> Better measurement of the retail economy must include consideration of capital expenditure and retail costs, together with the different roles played by different types of retail organisation within each administrative unit. As additional information becomes available it will be possible to include variables measuring change, or possibly to compare analyses for data referring to different years. The present study indicates that it is likely that there exist groups of administrative units which show an individual retail structure. Relationships of the retail economy measured within these groups show marked differences amongst groups. Memberships of these groups cuts across the usual division of administrative units into urban and rural categories, including in some groups both towns and Rural Districts. In respect of some relationships, groups of Rural Districts show what have hitherto been considered as urban traits, and similarly some urban groups show relationships classically ascribed to rural areas. Differences of scale exist in retailing between urban and rural areas, as is indeed indicated by central place theory, but the assumed differences in the retail functioning of urban and rural areas may be a fallacy. The limited evidence of the present study suggests that some rural and urban areas have a very similar retail structure.

University of Nottingham

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<sup>34</sup> D. C. D. Pocock and D. Wishart, Methods of deriving multifactor uniform regions, *Trans. Inst. Brit. Geogr.*, 47(1969), 73-98; A. J. Cole (ed.), *Numerical taxonomy*, 1968; D. Wishart, Fortran II programs for 8 methods of cluster analysis, *Computer contributions*, 38(1969).

## RETAIL CHANGE AND DECENTRALIZATION IN THE NOTTINGHAM METROPOLITAN COMMUNITY

JOHN A. GIGGS

A considerable amount of attention has been paid to the "metropolitan" form of community organization since R. D. McKenzie<sup>1</sup> identified its major structural attributes and formative forces in 1933. Most of the research has dealt primarily with aspects of population growth and decentralization;<sup>2</sup> comparatively little attention has been paid to the evolving retail structure<sup>3</sup> of the metropolitan communities. In this paper the retail geography of the Nottingham metropolitan community is examined from two perspectives:

(1) Firstly, the structure of the community is outlined and selected aspects of the recent growth and decentralization of retailing are reviewed and explained.

(2) Secondly, the changing retail structure of the community is examined and the functional and morphological attributes of five retail centres are outlined.

### THE STRUCTURE OF THE NOTTINGHAM METROPOLITAN COMMUNITY AND RETAIL CHANGE: 1951-1968

The study area is the metropolitan community of Nottingham. As defined by the author in Fig. 1, it is clearly structured spatially, consisting of three distinct but interdependent zones: the metropolis, or central city (Nottingham County Borough), the urban fringe or urban ring (the five peripheral Urban Districts of Hucknall, Arnold, Carlton, West Bridgford and Beeston and Stapleford) and the inner rural ring, a suburban zone consisting of 96 civil parishes, in which (1966) at least 50% of the commuting population was employed in either the metropolis or the urban ring.

Ideally, an analysis of retail change within the metropolitan community would include an examination of the number of retail outlets, together with

<sup>1</sup> R. D. McKenzie, *The metropolitan community*, New York, 1933.

<sup>2</sup> For example L. F. Schnore, *The urban scene*, New York, 1965.

<sup>3</sup> Notable exceptions include: B. J. L. Berry, The impact of expanding metropolitan communities upon the central place hierarchy, *Ann. Ass. Amer. Geogr.*, 50(1960); Idem, *Commercial structure and commercial blight*, Dept. Geogr., Univ. of Chicago Research Paper 85, 1963; J. W. Simmons, *The changing pattern of retail location*, Dept. of Geogr., Univ. of Chicago Research Paper 92, 1964; Idem, *Toronto's changing retail complex*, Dept. Geogr., Univ. of Chicago Research Paper 104, 1966.

their floorspace, number of employees and annual turnover. Unfortunately, published sources of statistics are inadequate and we are obliged to use surrogates for the statistics we really require. The only reliable sources of information relevant to the analysis are Local Authority General Rate Books and Valuation Books.<sup>4</sup> These provide an annual record of the number of retail outlets in each Local Authority area, but do not supply details of either size of premises or the specific types of retail functions present. Using either of these sources, therefore, we are able to trace changes in the numbers and locations

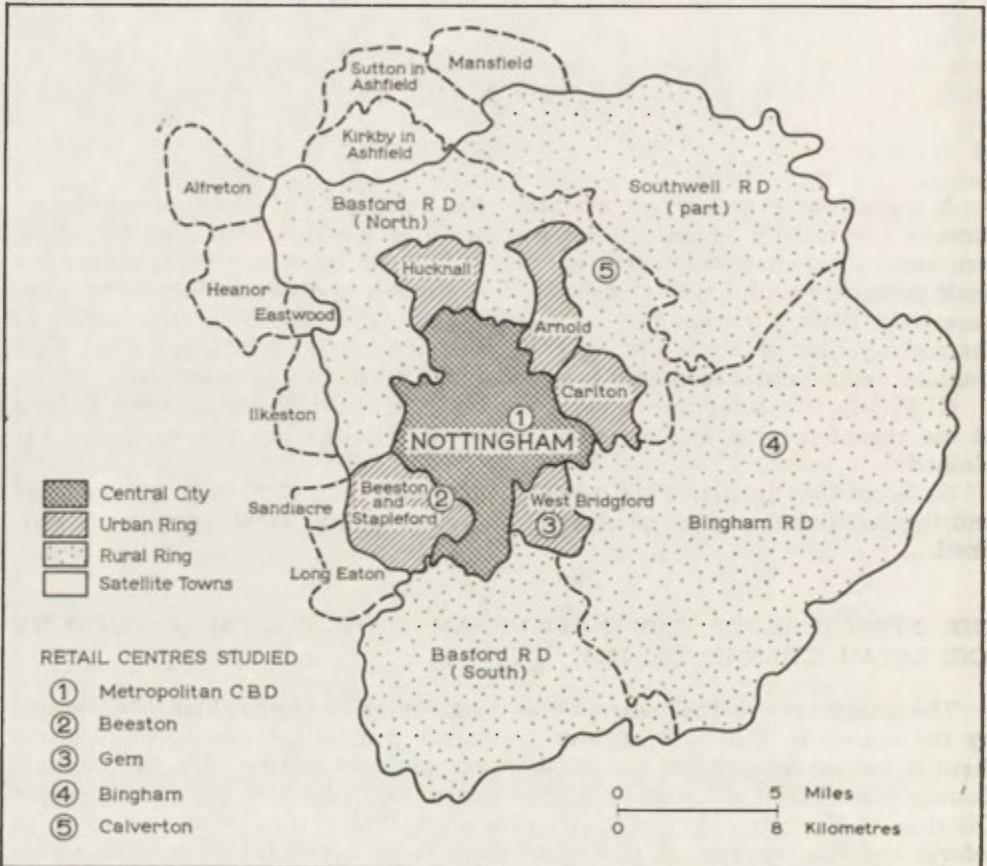


Fig. 1. The Nottingham metropolitan community

of retail outlets in any area over a selected period of time. The specific period under review (1951–1968) was chosen because detailed population census data for the sub-areas within the metropolitan community are also available for these two dates. The changing volume and distribution of retail outlets within the major zones of the metropolitan community are reviewed first; subsequently detailed locational changes within the rural ring are examined.

<sup>4</sup> For a discussion of these sources see W. K. D. Davies, J. A. Giggs, and D. T. Herbert, Directories, rate books and the commercial structure of towns, *Geography*, 53(1968).

## THE CHANGING DISTRIBUTION OF RETAIL OUTLETS IN THE METROPOLITAN COMMUNITY: 1951-1968

The broad changes in the numbers and distribution of outlets that have occurred within the constituent parts of the metropolitan community are summarized in Table 1. It can be seen (Part A) that the total number of outlets in the entire community declined slightly, solely as a result of substantial net losses within the central city. Part B of Table 1 shows that the rate of growth

TABLE 1. Changes in the retail structure of the Nottingham metropolitan community: 1951-1968

	A Outlets		B Change 1951-1968	C Share of total growth 1951-1968	D Total outlets	
	1951	1968	(%)	(%)	1958	1968
Total	8,899	8,858	-0.5	100.0	100.0	100.0
Central city	6,107	5,790	-0.2	—	68.6	65.4
Rings	2,792	3,068	+9.8	100.0	31.4	34.6
Urban	1,944	2,041	+5.0	35.1	21.9	23.0
Rural	848	1,027	+21.1	64.9	9.5	11.6

Source: Registrar General, *Census of England and Wales, 1951, County Report*—Nottinghamshire; *General rate books for City and County of Nottingham, 1951 and 1968*; *County Planning Department population estimates, 1968*.

in the rural ring was over four times as great as that in the urban ring. Part C reveals that the rural ring also accounted for almost two-thirds of the net retail growth in the metropolitan community during this period. The results of these outward shifts are summarized in Part D, which shows the propor-

TABLE 2. Population change in the Nottingham metropolitan community

	A Population (1,000)		B Change 1951-1968	C Share of total growth 1951-1968	D Total population	
	1951	1968	(%)	(%)	1951	1968
Total	537.5	611.6	13.7	100.0	100.0	100.0
Central city	308.2	305.2	-1.1	—	57.3	49.9
Rings	229.3	306.4	33.6	100.0	42.7	50.1
Urban	152.1	190.8	25.4	52.2	28.2	31.1
Rural	77.2	115.6	49.7	47.8	14.5	19.0

Source: As for Table 1.

tions of the total number of outlets contained in the three rings for 1951 and 1968. Despite substantial retail growth in the rings the central city's share of the total number of outlets in the metropolitan community fell only slightly.

These modest changes in this locational aspect of the retail geography of the metropolitan area can be explained mainly in terms of population growth and decentralization. Table 2 (Part A) shows that the population of the metro-

politan community has grown substantially during this period. The differential growth rates (Part B) reveal that the central city lost population and that the rate of increase in the rural ring was almost double that in the urban ring. In absolute terms, however, the urban ring acquired the greater share of total population growth (Part C). Part D of Table 2 presents the results of these changes, showing that the central city had a substantially smaller share of the total population in 1968 than in 1951.

The changes recorded here are thus similar to those outlined by Berry, who observed that "As metropolitan populations grow and redistribute themselves, retail facilities expand in areas where numbers of people are increasing and contract where they are decreasing".<sup>5</sup> The very sensitive parallel changes between regional levels of demand (population and purchasing powers) and supply (retail outlets) which Berry and others<sup>6</sup> have found in North American metropolitan areas, however, are not repeated here. If the levels of population and retail growth and redistribution presented in Tables 1 and 2 are compared then it becomes apparent that the state of imbalance has developed during this period. Table 3 expresses the change in terms of the average number of persons per shop, by rings, for 1951 and 1968.

TABLE 3. Average number of persons per shop in the Nottingham metropolitan community, by zones 1951 and 1968

	1951	1968
Total	60	75
Central City	51	53
Rings	82	103
Urban	78	94
Rural	91	113

It is clearly apparent that a population-retail outlet imbalance existed in the rings, as compared with the central city, in both years. Moreover, the situation worsened, rather than improved, over this period. The trend applies to the whole of the metropolitan community, but is least marked in the central city and most pronounced in the rural ring. The "phase shift" in the retail pattern has clearly been substantially slower and less pronounced than that of the population.

The widening disparity can be explained largely in terms of changes in consumer travel patterns which have been common to the entire country.<sup>7</sup> During the postwar period real incomes have risen sharply, roads have been improved and private forms of transport have expanded at the expense of mass-transport facilities. The frictions of space have consequently been reduced and

<sup>5</sup> B. J. L. Berry, *Geography of market centres and retail distribution*, Englewood Cliffs, N. J., 1967, p. 119.

<sup>6</sup> B. J. L. Berry (1960), *op. cit.*, Chap. 4.

<sup>7</sup> For a discussion of these changes see J. A. Gigg, *Fringe expansion and sub-urbanization around Nottingham 1931-68*, in: *Processes and patterns of urbanization*, Inst. Brit. Geogr., Keele, Sept. 1969.

metropolitan communities have expanded. Growing segments of all metropolitan populations choose to live in a semi-rural and rural surrounding and to travel to the metropolis for work, shopping and leisure activities. Existing studies of other metropolitan communities<sup>8</sup> reveal that it is the upper socio-economic classes that are moving from central to peripheral locations. Nottingham is no exception, for Table 4 shows that there has been increasing polari-

TABLE 4. Social class and mobility in the Nottingham metropolitan community, 1951 and 1966

	Social classes I and II <sup>1</sup>		Households with car
	1951	1966	1966 (%)
Total	13.8	14.0	43.1
Central City	13.3	10.4	34.0
Rings	16.0	17.5	54.2
Urban	19.8	16.6	51.3
Rural	3.7	18.7	58.2

<sup>1</sup>) % of economically active males

Source: As for Table 1. Also *Census of England and Wales, 1966*, special census tabulations held by Nottingham City and County Planning Departments.

zation of social classes over time. The new suburban (i.e., rural ring) communities, with their high levels of daily mobility, tend to use the wide range of existing retail facilities found in the central city. Further, the levels of population decentralization and personal mobility are not yet comparable with those found in North American metropolitan communities. Consequently the majority of retailers in the metropolis have not yet felt disposed to leave established locations or to set up branch premises in untested locations in the rural ring.

TABLE 5. Population and retail changes in the metropolitan ring: 1951-1968

Total population change 1951-68	Total parishes 1968 (%)	Total population increase in ring 1951-68 (%)	New retail outlets 1951-68	
			Number	total (%)
Loss	29	0	0	0
Gains 0- 1	48	3	7	4
1- 5	13	20	53	29
5-10	7	42	61	35
10-15	3	35	58	32
Total	100	100	179	100

Source: As for Table 1.

<sup>8</sup> L. F. Schnore, *op. cit.*, esp. pp. 201-251.

## THE CHANGING DISTRIBUTION OF RETAIL OUTLES IN THE RURAL RING: 1951-1968

At a more detailed level of analysis, it is possible to demonstrate the close relationship that exists between changes in retailing, population and settlements within the component parts of the metropolitan community. Analysis is restricted here to a brief consideration of changes within the rural ring.

Between 1951 and 1968 179 new retail outlets were added to the business stock of this outermost zone of the metropolitan community. No closures were recorded during this prosperous period. Table 5 and Figure 2 reveal that growth has not been widespread but has occurred in only a few of the 96 parishes in the area and principally in those located adjacent to the urban fringe. Thus

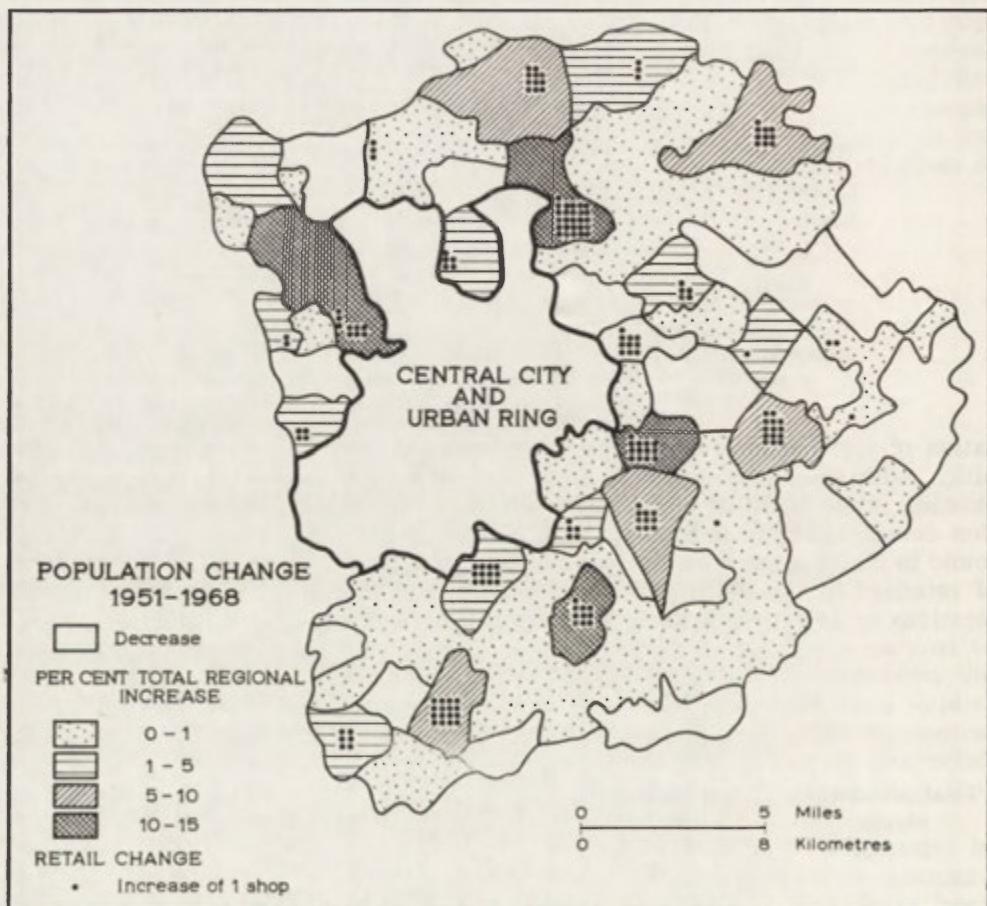


Fig. 2. Population change in the rural ring of the Nottingham metropolitan community  
 Erratum: to the north-east of the Central City the unshaded parish with dots should be shaded in the 10-15% increase range

only 22 per cent of the parishes accounted for 87 per cent of the new outlets. Table 5 and Fig. 2 also show that the greatest increments took place in those parishes which acquired substantial proportions of the total population increase occurring in the ring in these years.

Further analysis reveals that it is the parishes with the largest populations which generally made the greatest gains in terms of numbers of new outlets.

Thus parishes with populations of more than 2,500 (15 per cent of the parishes in the inner rural ring) accounted for 87 per cent of the total population growth and 80 per cent of the retail outlets during these years.

The pattern of retail development in this region, which is summarized in Tables 5 and 6 and in Fig. 2, is largely the product of planning policies initiated by the Nottingham County Planning Department. In 1947 the rural areas of the county were surveyed and "a hierarchy of settlements" was decided upon, so that future population growth would be channelled to those villages

TABLE 6. Population change and retail change by parishes in the rural ring: 1951-1962

Population range	No. of parishes		Total population growth	Total new retail outlets
	1951	1968	1951-68 (%)	1951-68 (%)
Under 1,000	71	65	2	3
1,000-2,500	17	16	11	17
2,500-5,000	6	7	30	33
5,000-10,000	2	7	56	47
Over 15,000	0	1	1	0
<u>Total</u>	<u>96</u>	<u>96</u>	<u>100</u>	<u>100</u>

Source: As for Table 1.

with existing or proposed facilities for shopping, social and medical services".<sup>9</sup> The outward flow of population, retail and service activities from the metropolis has thus been considerably restricted to limited number of parishes in the rural ring. Their villages have consequently assumed characteristics similar to those of the suburbs found in the inner rural rings of North American metropolitan communities. They have become dormitory settlements for workers employed in the metropolis, mining centres and service centres (Fig. 3A) for the more numerous smaller parishes, whose populations and retail facilities are becoming moribund or stagnant. The pattern and scale of retail and population redistribution outlined here are consequently very different from the extensive unplanned urban sprawl which characterizes the fringes of most North American central cities.<sup>10</sup>

#### THE CHANGING RETAIL STRUCTURE OF THE NOTTINGHAM METROPOLITAN COMMUNITY: 1941-1970

It is apparent from the preceding section that the spatial pattern of retailing in the metropolitan community changed over the period 1951-68. Objective measurement of *functional* changes is possible only over a longer period, using data taken from the most recent comprehensive Commercial Directory for the area (published in 1942)<sup>11</sup> and a detailed field survey conducted in March, 1970.

<sup>9</sup> Nottinghamshire County Council, County Planning Department, *Rural Nottinghamshire*, 1(1969), p. 3.

<sup>10</sup> See, for instance, J. Gottmann, and R. A. Harper, *Metropolis on the move*, New York 1967, pp. 36-42, 93-101.

<sup>11</sup> Kelly's Commercial Directory, *Nottingham and Nottinghamshire*, London, 1942.

## FUNCTIONAL CHANGE IN THE METROPOLITAN COMMUNITY 1941-1970

For the purposes of this general survey retail centres were defined as clusters of four or more contiguous establishments. The establishments selected for analysis were restricted to those performing the set of retail functions employed by Davies<sup>12</sup> in his study of centrality and the central place hierarchy in the Rhondda valleys. In order to determine the relative centrality of each centre

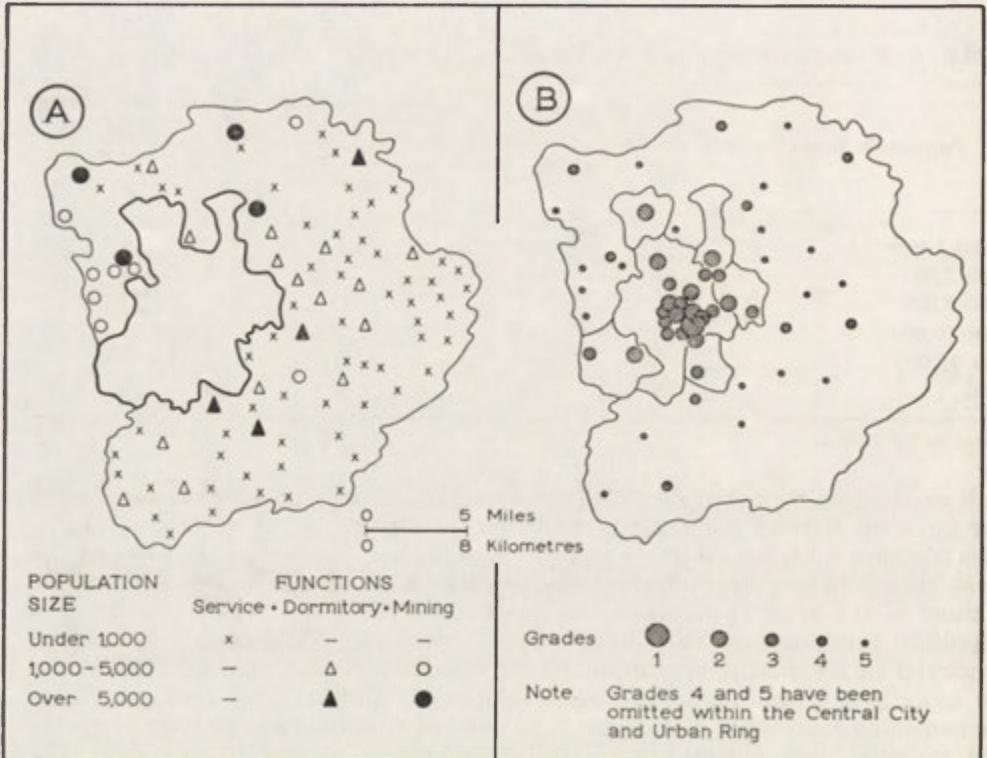


Fig. 3. The Nottingham area: A — Suburban size and functional structure (1968), B — Hierarchical grades of shopping centres (1970)

the objective measure devised by Davies in that study was used to assign functional index values to the retail centres. A location coefficient was calculated for each establishment, of all functional types, using the formula:

$$C = \frac{t}{T} \times 100, \quad \text{where:}$$

- $C$  = centrality value for any type of establishment  $t$ ,  
 $T$  = total numbers of outlets of good  $t$  in all the centres,  
 $t$  = one establishment of type  $t$ .

The number of outlets of each functional type in each centre was multiplied by the relevant location coefficient, providing centrality values for all the

<sup>12</sup> W. K. D. Davies, Centrality and the central place hierarchy, *Urban Stud.*, 1967, and Towards an integrated study of central places, Chap. 9, in: *Urban essays: studies in the geography of Wales* (ed. W. K. D. Davies, and H. Carter), London, 1970.

functions characteristic of each centre. Addition of the centrality values scored by each centre produces functional index values.

Functional indices for each centre were calculated for 1941 and 1970. These were converted to percentages, then ranked and plotted as Lorenz curves (Fig. 4). The figure shows that the metropolitan central business district (C.B.D.) dominated the community in 1941. Subsequent population and retail growth in the urban and rural rings has produced a relative deconcentration in the functional pattern.

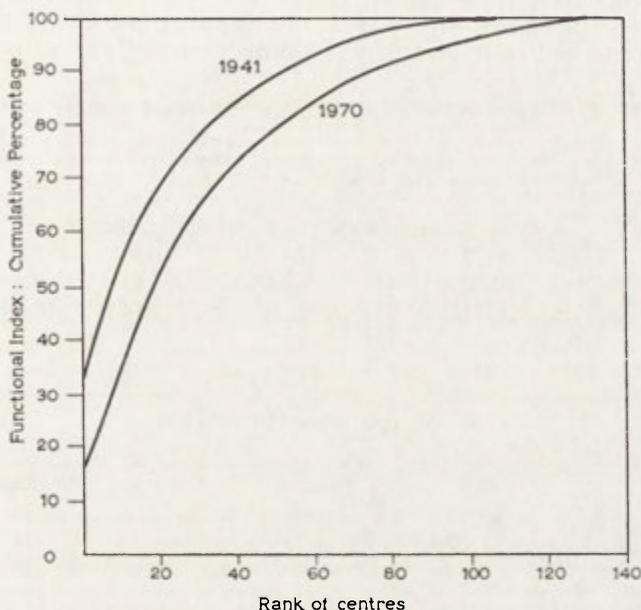


Fig. 4. Functional change in the metropolitan community, 1941-1970

If the functional index values for each centre are ranked a distinct hierarchy emerges. The results, for 1970, are tabulated below (Table 7) and presented also in Fig. 3B. It is apparent that the retail pattern of the metropolitan community is highly structured and that it becomes progressively less complex in the intermediate and peripheral rings.

TABLE 7. Grades of central places in the Nottingham metropolitan community: 1970

Level	Range of functional index values	Location of centres			Total
		Central City	Urban Ring	Rural Ring	
1	774.5	1	—	—	1
2	121.7-267.6	7	4	—	11
3	46.8- 92.6	8	5	—	13
4	27.4- 41.3	12	8	8	28
5	0.7- 21.8	37	18	23	78
<b>Total</b>		<b>65</b>	<b>35</b>	<b>31</b>	<b>131</b>

Source: Field work, March, 1970.

## FUNCTIONAL CHANGE IN SELECTED RETAIL CENTRES: 1941-1970

A complete survey of functional changes in all the retail centres is not feasible here and an examination of the dynamic process is consequently restricted to five selected centres of differing grades and locations. The five centres are the metropolitan C.B.D. (grade 1), Beeston centre (grade 2), Gem Supercentre (grade 3), and Bingham and Calverton centres (grade 4). The locations of the five centres are shown in Fig. 1 and their distribution vis-à-vis all the other centres in the community can be seen in Fig. 3B. Three of the centres (the C.B.D., Beeston and Bingham), are all old-established foci; Calverton has been extensively modified since 1941 and Gem Supercentre, the only large planned shopping centre in the metropolitan community, was opened in 1964.

TABLE 8. Changes in the retail structure of selected centres: 1941-1970

A. Number of outlets: 1941-1970									
	C.B.D.		Beeston		Gem	Bingham		Calverton	
	1941	1970	1941	1970	1970	1941	1970	1941	1970
Food	162	78	84	46	4	13	6	11	7
Other goods	455	573	93	91	16	14	12	3	11
Services	112	191	12	22	9	4	6	3	5
<b>Total</b>	<b>729</b>	<b>842</b>	<b>189</b>	<b>159</b>	<b>29</b>	<b>31</b>	<b>24</b>	<b>17</b>	<b>23</b>

B. Per cent change: 1941-1970					
	C.B.D.	Beeston	Gem	Bingham	Calverton
Food	-52	-45	—	-54	-36
Other goods	+26	-2	—	-14	+267
Services	+71	+83	—	+50	+67
<b>Total</b>	<b>+16</b>	<b>-16</b>	<b>—</b>	<b>-23</b>	<b>+35</b>

C. Per cent total outlets: 1941 and 1970									
	C.B.D.		Beeston		Gem	Bingham		Calverton	
	1941	1970	1941	1970	1970	1941	1970	1941	1970
Food	22.2	9.2	44.4	28.9	13.7	41.9	25.0	64.6	30.4
Other goods	62.4	68.0	49.2	57.2	55.1	45.1	50.0	17.7	47.8
Services	15.4	22.8	6.4	13.9	31.2	23.0	25.0	17.7	21.8
<b>Total</b>	<b>100.0</b>								

Source: Kelly's Commercial Directory, Nottingham and Nottinghamshire (London, 1942) and field work, March, 1970

Table 8 shows the number of establishments in each of the four established centres, grouped into three major functional classes, for 1941 and 1970; the figures for Gem Supercentre are presented only for 1970. Part A shows that the number of outlets in each of the functional classes has changed considerably and that two of the established centres have experienced absolute increases (C.B.D. and Calverton), while the other two (Beeston and Bingham) have experienced absolute decreases. The increments experienced by the C.B.D. and Calverton centres, together with the building of Gem Supercentre, can be attributed to substantial population increases in their respective hinterlands. The populations of the Beeston and Bingham centres also rose during this

period, although the number of outlets declined. However, field evidence revealed that the losses in absolute numbers of outlets were offset by major increases in the floorspace of surviving premises. This theme is discussed in greater detail in the next section (changes in morphology).

Part B of Table 8 summarizes the changes that have occurred in the number of establishments in the individual functional classes, for each centre. Service outlets have increased in importance in every centre. In three cases (C. B. D., Gem and Calverton) there have been gains in the number of establishments selling non-food goods. In the two centres where losses occurred (Beston and Bingham) there were compensating gains in terms of increased floorspace in the surviving establishments. The numbers of shops selling food-stuffs have fallen in the four centres which were established prior to 1941. Gem Supercentre is atypical because of the late date at which it was opened. The results of these trends are summarized in Part C. It can be seen that the proportions of total outlets selling non-food goods and services have increased significantly.

The changes in the size and functional composition of the five centres discussed here reflect changes in demand and supply factors at both national and local levels. These have already been discussed fully in the literature;<sup>13</sup> thus only the major formative factors need be mentioned here. Rising real incomes<sup>14</sup> have created a growing demand for non-essential goods and services and consequently smaller proportions of individual incomes are spent on food-stuffs. Greater personal mobility<sup>15</sup> (reflected in the growing number of private cars), has meant that consumers can now choose between a number of alternative retail centres. In consequence, street-corner shops have tended to disappear and retailing has polarized in the higher-order centres within metropolitan communities. Faced with these changes retailers have attempted to reduce costs and gain economies of scale by building fewer but larger stores. These new outlets have generally been built in the more accessible, established, centres.

#### MORPHOLOGICAL CHANGES IN THE SELECTED RETAIL CENTRES: 1950-1970

During the postwar years the form (or morphology) of traditional retail centres within the metropolitan community has changed in concert with functional and technological innovations. The new space requirements demanded in retailing, combined with functional and physical obsolescence and contemporary traffic congestion, have seriously threatened their viability. In addition, new types of centres have been built in the urban and rural rings. During this period both the physical redevelopment of traditional centres and the design of new centres have been guided by Local Authority Planning Departments. The beginnings of this phase of public and private co-operation can be traced to the publication of "The Redevelopment of Central Areas" by the Ministry of Housing and Local Government (then called the Ministry of Town and Country Planning) in 1947.<sup>16</sup> Since then the broad principles of design have

<sup>13</sup> See, for instance, N. A. H. Stacey, and A. Wilson, *The changing pattern of distribution*, London, 1965, rev. ed.

<sup>14</sup> Between 1951 and 1966 the average income per capita in the U. K. rose by 35% (at 1958 prices) (*National income and expenditure*, H. M. S. O., London, 1969).

<sup>15</sup> The number of cars in the U. K. rose from 2 to 10 millions between 1951 and 1966 (*The motor industry of Great Britain*, London, 1969).

<sup>16</sup> Since 1947 the Ministry of Housing and Local Government and the Ministry

also been applied to outlying shopping centres in the major urban areas.

In order to demonstrate the type and scale of morphological changes and the role of planning decisions in these developments, the five centres examined in the previous section are briefly reviewed here. Two separate authorities have been responsible for planning decisions within the metropolitan community. The Nottingham City Planning Department has tried to solve the problems of the metropolitan C. B. D. and to maintain and even improve its competitive position. The Nottinghamshire County Planning Department, on the other hand, has attempted to redress the population-retailing imbalance which has developed in the urban and rural rings.

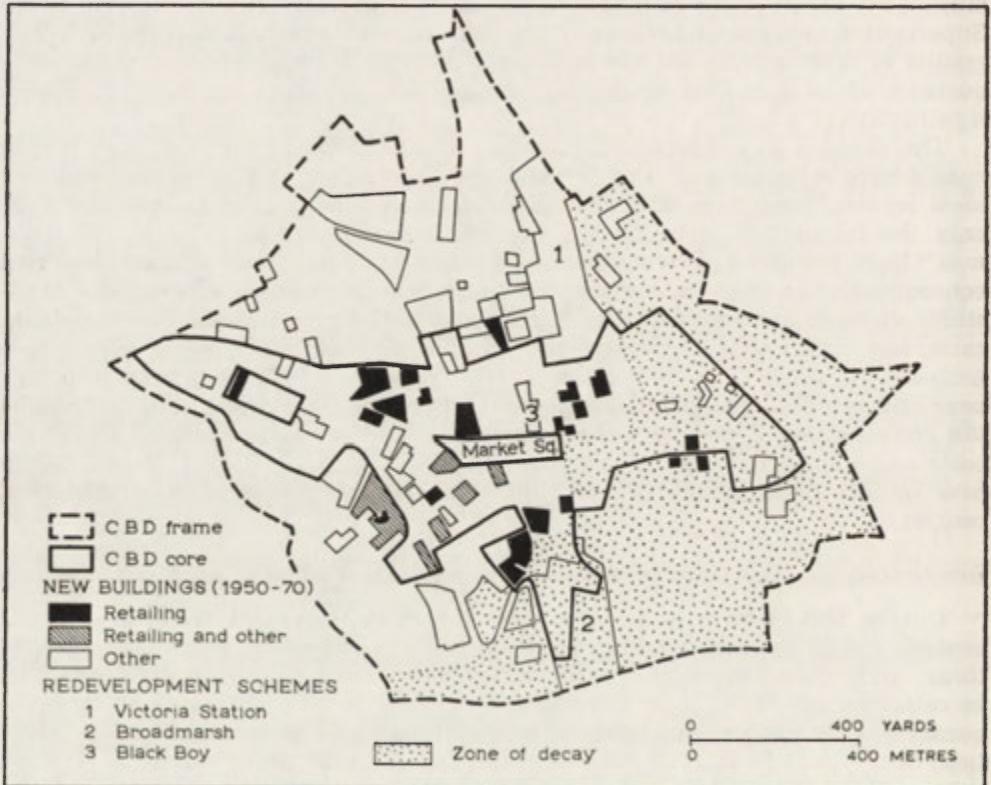


Fig. 5. Metropolitan C.B.D.—structure and change, 1950–1970

(1) *The C. B. D.* The main structural components of the C. B. D. in 1964<sup>17</sup> are summarized in Fig. 5. Two regions are distinguished. The first is an inner region (the core) in which over 50% of the total floor space in each block is

of Transport have together published a number of bulletins on urban renewal, notably: Bull No. 1, *Town Centres, approaches to renewal* (H. M. S. O., London, 1962). Bull. No. 3, *Town centres, cost and control of redevelopment* (H. M. S. O., London, 1963).

Bull. No. 4, *Town centres, current practice* (H. M. S. O., London, 1963).

<sup>17</sup> In 1964 the Nottingham City Planning Department completed a floorspace survey of the C. B. D. on a block basis.

given over to the assemblage of uses employed by Murphy and Vance<sup>18</sup> in their studies of United States central business districts (i.e. retailing, commercial offices, entertainment and hotels). Fringing this region is an area in which over 50% of the total floor space in each block consists of the "frame" uses identified by Horwood and Boyce<sup>19</sup> (i.e. education, medical, cultural, government and public uses, warehousing, wholesaling, light industry and transportation termini).

The major land-use changes which have occurred during the period 1950-1970 are also presented in Fig. 5. It is evident that substantial redevelopment has taken place, in response to new demands. Most of the new buildings are multi-storey units, located in a zone of assimilation, to the north and west of the Market Square. The area to the south and east of the Market Square is a zone of decay, with large numbers of vacant premises. The operation of planning principles is reflected in the marked zonation of new buildings. Thus increments to the retailing sector are chiefly found within the core of the C. B. D., while new buildings given over to other uses are concentrated in the frame. The core has extended westwards however, since 1964, and two large regions which are currently being redeveloped as covered retailing centres (i.e., the Victoria Station and Broadmarsh sites) are both located outside the core of the C. B. D.

TABLE 9. Floorspace of major uses in the C.B.D.: 1948 and 1970  
(1,000 m<sup>2</sup>)

	1948	1970
Core Uses	602	1,000
Retail	280	536
Commercial offices	180	242
Entertainment	66	132
Hotels	76	90
Frame Uses	848	946
Total	1,450	1,946

Source: Nottingham City Planning Department, First and third land-use surveys, 1948 and 1970.

The cumulative effects of these changes are summarized in Table 9. Despite population decentralization and the associated growth of new retail centres in peripheral locations, the total floor area of the metropolitan C. B. D. increased by 34 per cent between 1948 and 1970. More important, the area devoted to retailing increased by 91%. It is evident that the C. B. D. has maintained, and even intensified, its position as the principal shopping centre in the metropolitan community. Further massive extensions to the retailing floorspace are already under construction. By 1975 there will be a net gain of 102,200 m<sup>2</sup>.

(2) *Beeston centre*. The major structural changes for Beeston retail centre are presented in Fig. 6. Although the total number of shops declined between 1941 and March, 1970 (Table 8) it can be seen that the area given over to retailing has grown considerably. As a result of controlled expansion, land-use

<sup>18</sup> R. E. Murphy, and J. E. Vance, *Delimiting the C. B. D.*, *Econ. Geogr.*, 30(1954).

<sup>19</sup> E. M. Horwood, and R. R. Boyce, *Studies of the Central Business District and Urban freeway development*, Seattle, 1959.

segregation has been intensified. Shops have been extended laterally along the frontages of the two main streets and backwards to the limits of the individual plots. Housing has largely been eliminated from the main streets by these processes. Frame uses now fringe the principal retail axes. The centre of gravity of this Grade 2 centre is located at the intersection of the two roads. A large new shopping precinct is currently being built in this area. By the end of 1971 54 new shops will have been built on this site at a cost of over £1 million.

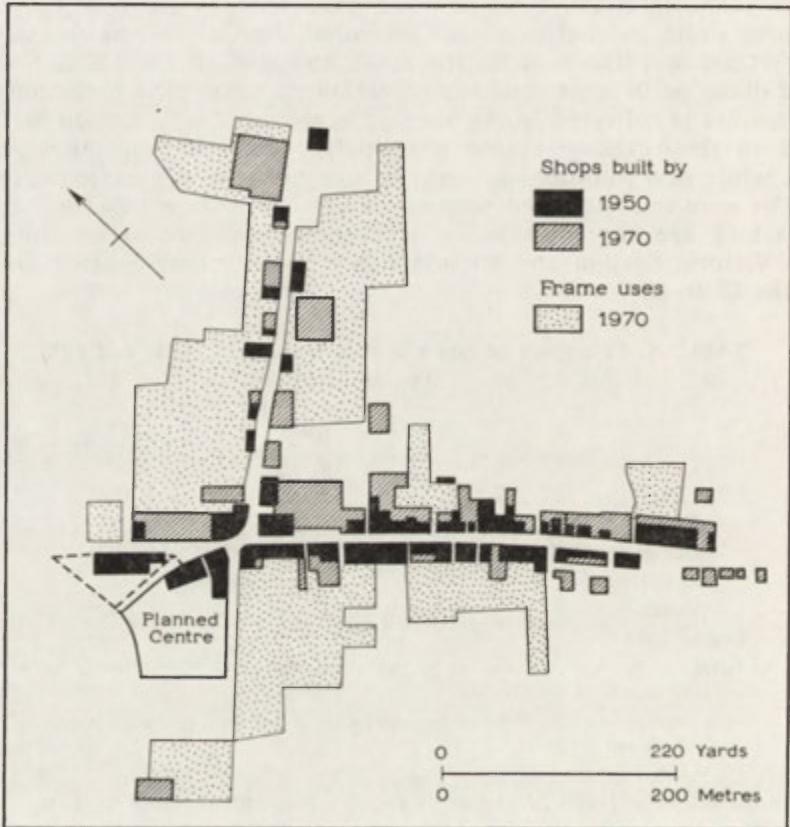


Fig. 6. Beeston shopping centre — structure and change, 1950–1970

(3) *Gem Supercentre*. This store, the first of its kind in the U. K., is the only large, planned, shopping centre in the metropolitan community. It is a self-contained, low-priced, “one-stop” shopping centre, and is similar to discount houses found in the United States. It has a total floor space of 10,220 m<sup>2</sup>, of which 6,500 m<sup>2</sup> are given over to retailing. The store has on-site parking facilities for 1000 cars. It was originally built by Gem Supercentres Incorporated, a U. S. firm, but since 1966 it has been owned by A. S. D. A. (Associated Dairies), a Leeds-based firm. The store, a grade 3 centre, ideally fills the gap in retailing hierarchy which existed in the area south of the River Trent until 1964. In 1961 there were 150 persons per shop in West Bridgford, compared with an average of 116 per shop for the entire urban ring. The only competi-

tion in the region is provided by the old West Bridgford retail centre (grade 4), located 1.6 km away.

(4) *Bingham centre.* The population of this Rural District service and administrative centre increased by 185 per cent between 1951 and 1968. Most of the new residents work (66% in 1966) and shop in Nottingham; consequently ex-

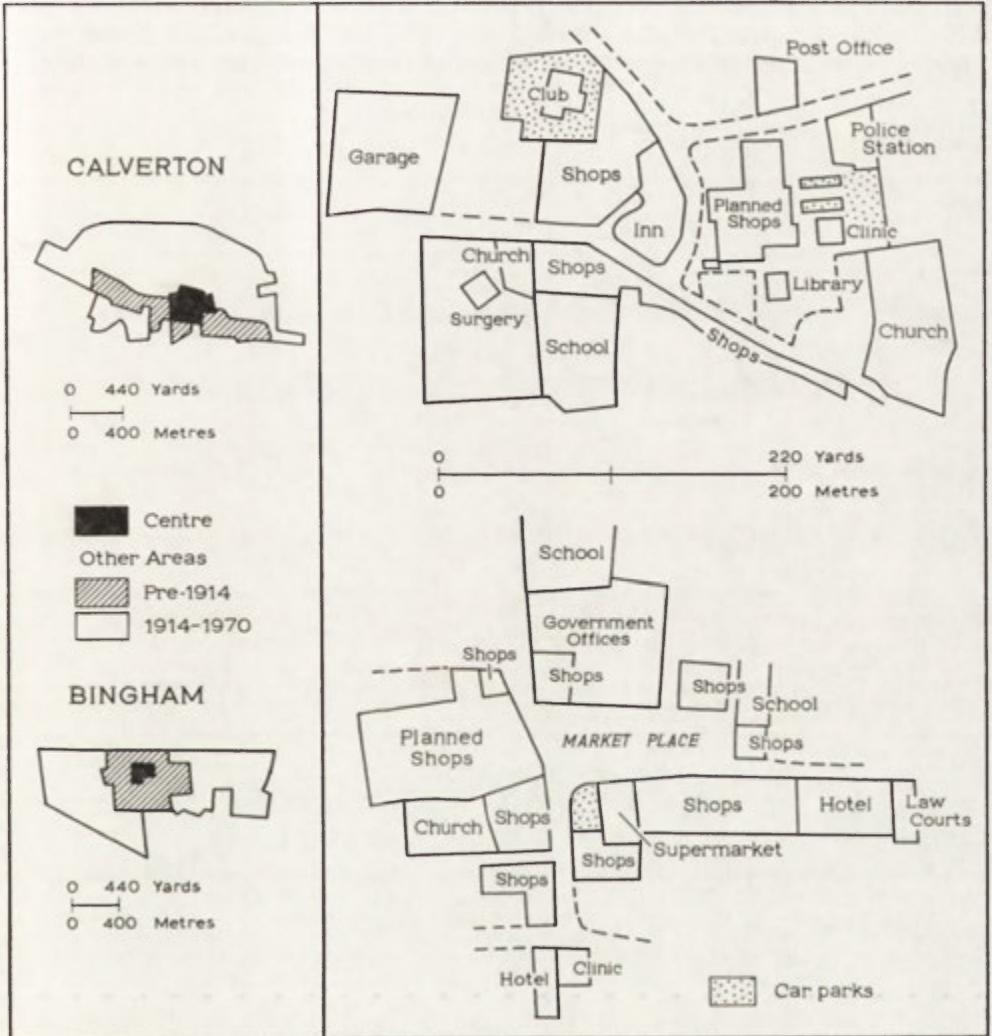


Fig. 7. Calverton and Bingham shopping centres

tensions to the existing retail facilities have been relatively modest. The total number of outlets located around the market square (Fig. 7) declined from 27 in 1941 to 18 in 1970, primarily because a few successful businessmen had bought up and consolidated a number of contiguous, but formerly distinct, premises. A single new supermarket has been built on the south side of the market square, but most of the new stores are located in the outlying residential estates. In an effort to maintain the importance of the central shopping area

the County Planning Department approved the building of 14 new shops and a supermarket in a precinct located on the west side of the market square. The scheme will be completed late in 1970.

(5) *Calverton centre*. Since 1951 Calverton has been transformed from a small *Strassendorf* village (Fig. 7) into a large coal-mining village and dormitory suburb. Annual coal output is about 1 million tons. The population increased by over 400% between 1951 and 1968. The existing shopping centre has been enhanced by the construction of a planned precinct (completed in 1966), containing 15 shops, a post office, library, clinic and police station.

University of Nottingham

## HINTERLANDS OF RURAL-URBAN INTERACTION WITH SPECIAL REFERENCE TO THE NORTH-WEST MIDLANDS OF ENGLAND

PHILIP T. KIVELL

### INTRODUCTION

The distinction between what is rural and what is urban has long been debated by geographers, sociologists and laymen, but in much of Britain there is an increasingly strong case for dropping the former term altogether. For administrative purposes we still have a sharp division between Rural District Councils and the urban authorities of varying status, but the long-apparent fallacy of this division has been reinforced by the evidence submitted to the Redcliffe-Maud Commission and the report made by it.<sup>1</sup> Differences in land use and population density perhaps indicate a nominal division between town and country, but in the fields of employment, shopping and service provision and leisure activity a complex system of linkages is continually drawing the town and country closer together. It is recognized that this interaction between town and country is distinctly a two-way process, but here it is intended to examine only the way in which rural areas depend upon, and are influenced by towns of different status. "Rural" for the purposes of this paper will be taken as those local government areas which were designated as Rural Districts at the time of the 1961 census, although the shortcomings of this definition are recognised.

By analysing the behaviour of consumers of goods and services in the rural areas around a group of small and medium-sized towns in the north-west Midlands (Fig. 1) it is hoped that this paper will contribute to an understanding of the nature of rural-urban interaction. The exercise should be seen as a test of several postulates as to the nature of urban hinterlands, and is designed more to stimulate discussion than as a firm base from which to draw definite conclusions about rural-urban interaction. In turn, this should focus attention upon one of the most acute problems with which planning is faced; that is the most harmonious and effective integration of town and country.

### DELIMITATION OF HINTERLAND BOUNDARIES

There are many ways of measuring the influence which a town exerts over a rural area, and of demarcating the boundaries of that influence,<sup>2</sup> and the emphasis here has been placed upon the movement patterns of rural consu-

<sup>1</sup> *Report of the Royal Commission on Local Government in England, 1966-1969* (H. M. S. O., 1969).

<sup>2</sup> H. Carter, *The towns of Wales*, 1965, pp. 105-140.

mers and particularly the frequency with which they visit a single town or a number of towns. In the absence of detailed figures on the expenditure of households, the frequency of shopping visits to a town can be taken as an acceptable measure of the intensity of rural-urban linkage.

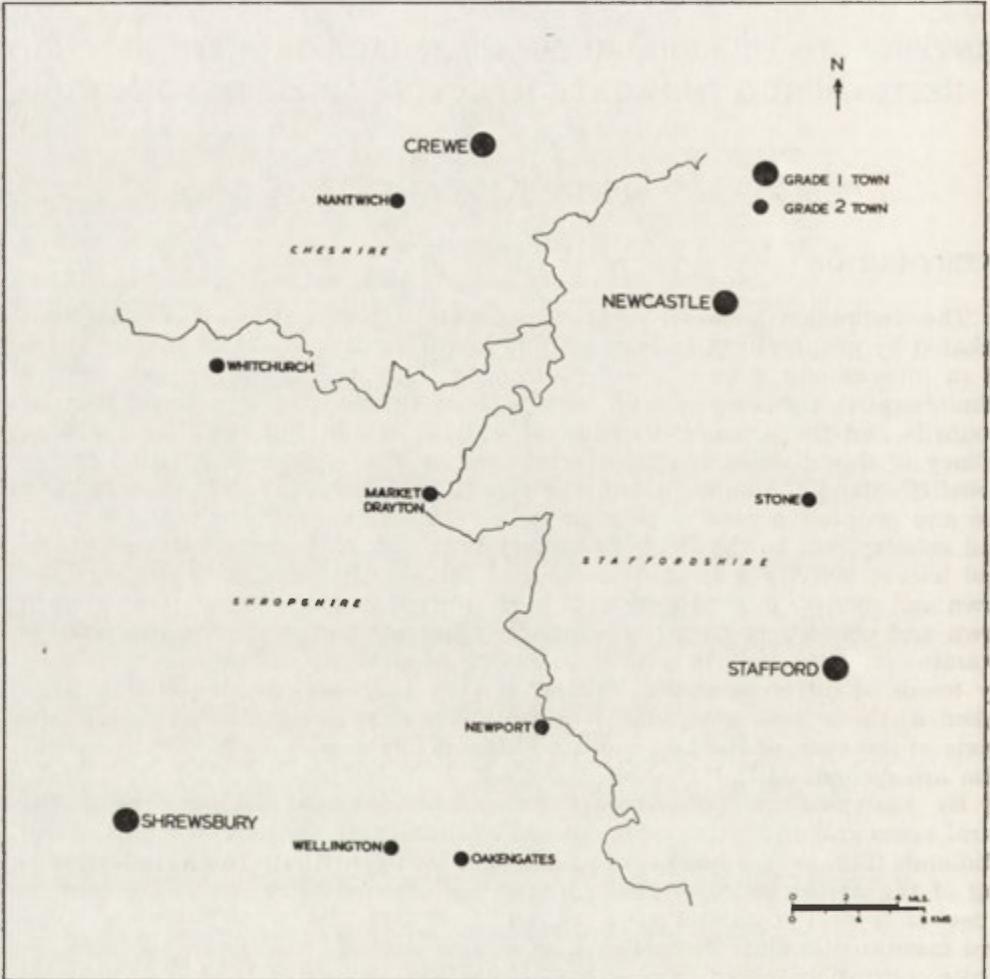


Fig. 1. Location of grade 1 and grade 2 towns

The frequency of visits by rural people to the towns in Figure 1 was obtained from a postal survey. Questionnaires were sent to a random sample of  $2\frac{1}{2}\%$  of the households in non-urban areas, the Rating and Valuation Lists of local authorities serving as a sample frame. Many factors influence the frequency with which an individual visits a particular town, for instance the rank and size of the town, the adequacy of local shops and services within the rural area, the level of personal mobility of the rural population and its purchasing power, but for the purposes of this study it was postulated that distance from the town would be a major determining factor. Garner<sup>3</sup> suggests that "The

spatial distribution of human activities reflects an ordered adjustment to the factor of distance'. Isochrones of travel time by car were drawn around each town, and the frequency of visits by rural people to each town was related to their travel time. Travel times were calculated according to average speeds recommended in "The Haydock Study",<sup>4</sup> viz. trunk roads — 40 mph (64 km/h),

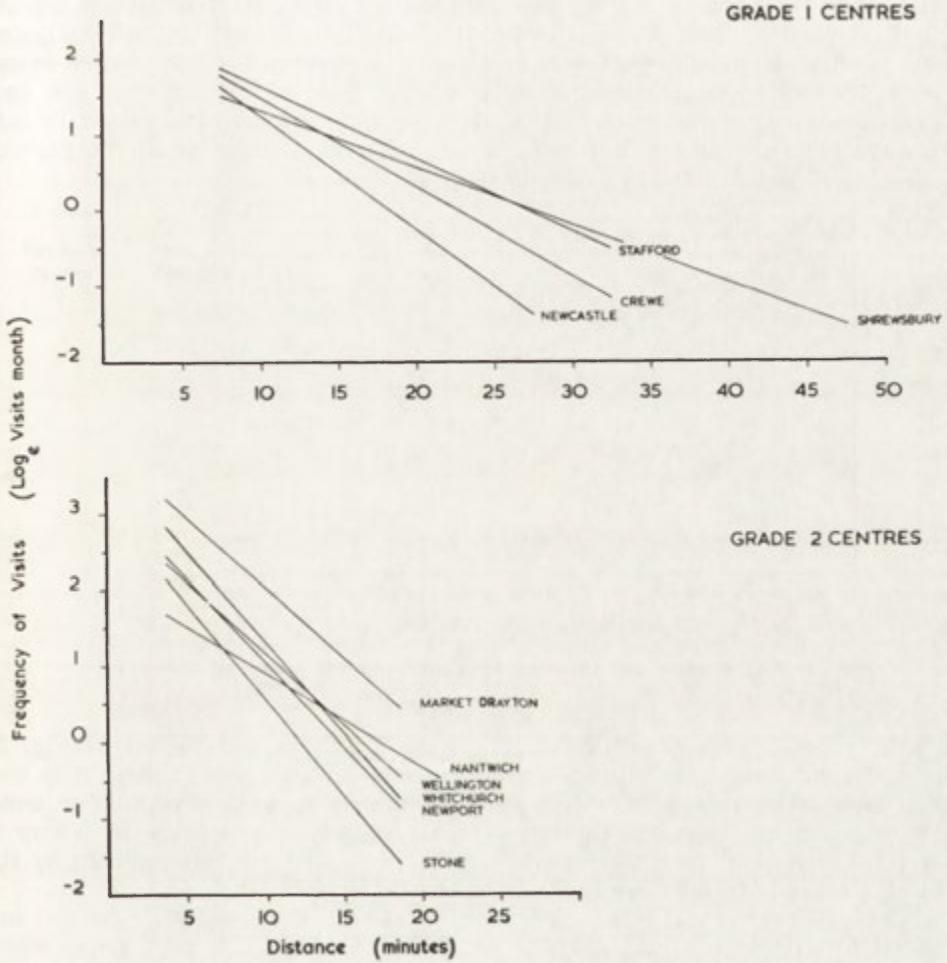


Fig. 2. The distance-decay function of shopping frequency

main roads 30 mph (48 km/h), urban and minor country roads 20 mph (32 km/h). Of all respondents 73% had access to a motor car for shopping purposes.

Many hinterland studies represent the limit of one town's influence or its hinterland boundary by a single line, but in reality the nature of the zone of

<sup>3</sup> B. J. Garner, in: R. J. Chorley and P. Hagget (Eds.), *Socio-economic models in geography*, 1969, p. 304.

<sup>4</sup> University of Manchester, *The Haydock Study: regional shopping centres in North-west England*, 1964.

influence is far more complex than this would imply. Here the frequency of visits to a town have been graphed against distance to give a general expression of a town's hinterland and this must be stated as a gradient.

To emphasise the different use-characteristics of towns of different rank, the centres were divided into two groups according to their provision of retail and service facilities. This ranking and the division of the settlements into two groups was achieved by the method outlined by W. K. Davies.<sup>5</sup> Group 1 comprised Newcastle under Lyme, Crewe, Stafford and Shrewsbury, with populations ranging from 48,000–76,000, and group 2 consisted of the other seven towns. These had populations of between 4,370 and 13,650. Each town had a graphically-expressed relationship with its hinterland which varied in minor ways from the others, but in each case an exponential line of the general

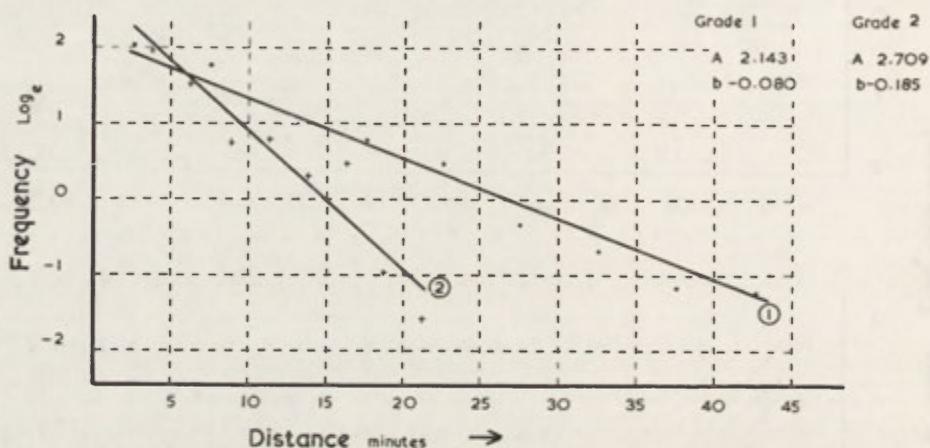


Fig. 3. Aggregated distance-decay functions of shopping frequency

from  $y = Ae^{-bx}$  provided a good fit. These gradients are shown in Fig. 2. Among Group 1 centres, Shrewsbury's influence declines more gently than the rest, owing to its isolated westerly position in an area of low population density, but there is a marked similarity in all of the relationships. In Group 2 only Nantwich stands slightly apart from the rest and this is explained by its greater size and its superior range of specialist shops.

In order to seek any more general relationships which may lie behind individual instances and their possible anomalies, the data for each group were aggregated to produce Fig. 3. The aggregated distance-decay functions for the two groups emphasise the differences between grade 1 and 2 centres which was implicit in Figure 2. The contrasting nature of influence and rural-urban shopping linkages of the two groups is quantified by the slope of the line, the  $b$  coefficient. Grade 1 centres with a  $b$  coefficient of  $-0.080$  have a relatively gentle rate of distance-decay to a maximum range of 45 minutes, at which point the frequency of visits to the centre was once in four months. The influence of the smaller, grade 2 centres is seen to decline more rapidly ( $b = -0.185$ ) to a maximum range of 22.5 minutes, where the frequency was one visit each five months.

<sup>5</sup> W. K. Davies, *Centrality and the central place hierarchy*, *Urban Stud.*, 1(1967), pp. 61–79.

These gradients should be seen as postulated basic relationships, an attempt to quantify and explain the general pattern of urban domination of rural areas, and as an illustration of the distinction between centres of different orders within a particular urban system. From this it should not be concluded that grade 1 centres are situated 90 minutes apart, and grade 2 towns 45 minutes apart, for the basic relationship conceals the fact that there is considerable overlap between the fields of influence of adjacent centres and that in particular cases the road network can compress or extend the field of influence.

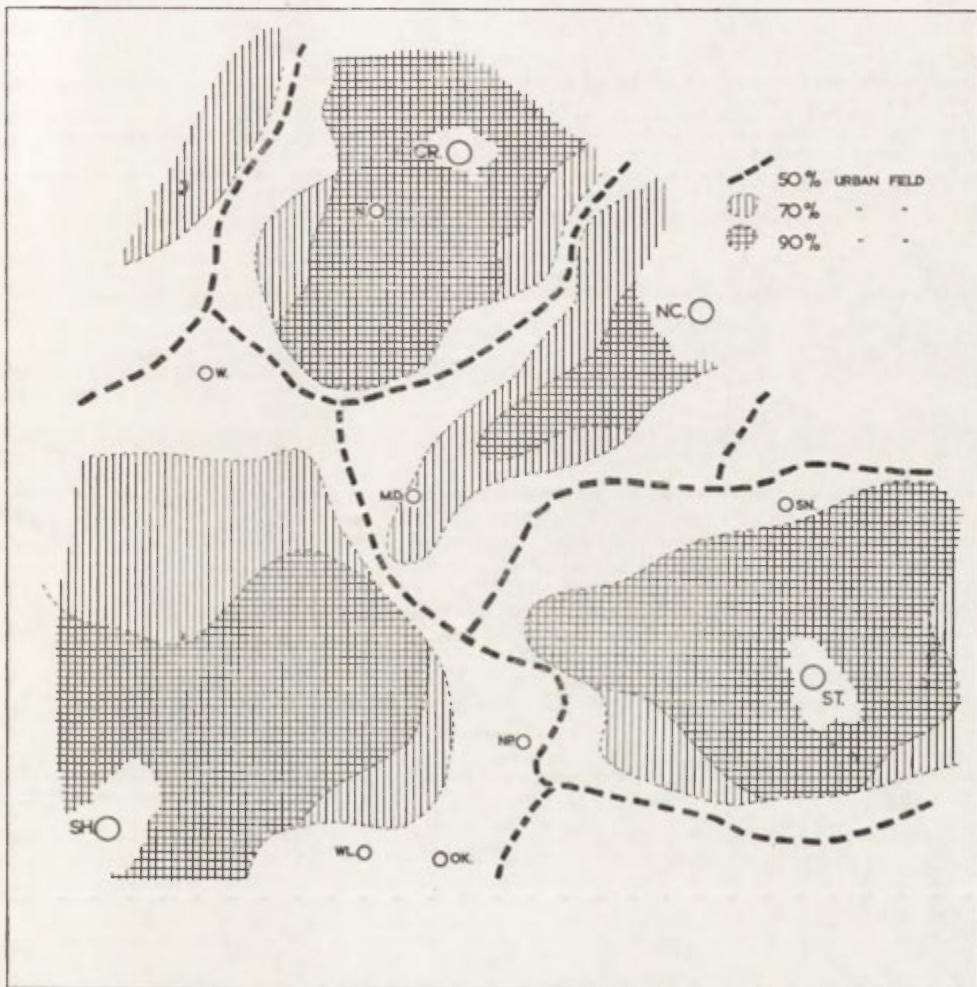


Fig. 4. Hinterlands of grade 1 towns

Thus Stone and Oakengates are both weak grade 2 centres due to competition from Newcastle and Stafford in the former case and Wellington and Newport in the latter.

The settlements in this area were originally divided into two hierarchical groups on the basis of their functional provision. The distance-decay functions

have shown that there are real differences also between the way in which each group of towns is used for shopping purposes by rural people, thus providing further evidence to show that the division chosen was a realistic one. This suggests that the examination of distance-decay functions for different centres has a valid role in the study of central-place relationships and the resolution of hierarchical groupings.

Individual differences in hinterland extent which are concealed by the general gradients of Fig. 3 can be seen on Figure 4. The hinterlands shown here



Fig. 5. Hinterlands of grade 1 and grade 2 towns

are far from regular in shape or extent. Referring back to the simple concept that a hinterland may be seen as a single boundary line, it is clearly possible to construct such a line around each town, but this involves considerable generalization of an arbitrary kind. For example the broken line in Figure 4 encloses the area from which at least 50% of locally-generated shopping trips

are made to each town. This, then, is the break point where two adjacent towns are equal in attraction: it is a convenient illustration of the general extent of urban hinterlands, but it conceals as much of the truth as it reveals.

That a single line obscures the variations in intensity with which different parts of a hinterland are linked to a town is shown by constructing isopleths enclosing areas where (say) 70% and 90% of shopping journeys are made to the centre being examined. There is a change of emphasis here in that the intensity of the rural-urban linkage is being measured not by the frequency of visit to the central town, but by considering the proportion of shopping journeys which are made to each centre. In this case the intensity of the interaction does not depend purely upon distance; the zones within which 90%, 70% and 50% of journeys are made to one centre, unlike the zones of frequency, are not concentric, and, depending upon local transport networks and the degree of competition from other centres, the three isopleths can run together for short distances.

Figure 5 illustrates that at a finer level of enquiry (here grade 2 centres are considered in addition to grade 1) areas exist where the competitive influence of several towns interfere and no centre claims even 50% of shopping journeys. These are areas that lie outside any simply defined hinterland pattern. There are five such areas of interference on the map, the most important being those around the towns of Stone and Oakengates.

Thus the exponential distance-decay function provides an adequate measure of one dimension of a town's influence over its surrounding rural district, but if the interaction is measured as a proportion of all rurally-generated shopping trips attracted to the town its intensity varies in strength and extent throughout the hinterlands, as shown by Figures 4 and 5. Thus to consider a hinterland boundary as a single line is artificial, for it obscures variations in the intensity of hinterland affiliation and it also conceals areas where no individual town is dominant.

#### CONSUMER BEHAVIOUR AND THE RANGE OF A GOOD

Apart from being determined by distance, the nature and extent of urban influence over a rural district varies with the kind of good or service being considered. This introduces the concept of the range of a good, of which Berry<sup>6</sup> says "...the minimum size of market area required for support of successively lower order goods will be progressively less than the hexagons for the highest good order." Thus it would be expected that each town would be surrounded by a series of catchment areas, the size of which would vary according to the nature of the service to which it related.

The way in which rural people purchase a list of eight goods and services was investigated by means of the questionnaire, and although variations were found in the patterns resulting from the provision of each item, it was perhaps equally significant that marked similarities were also noticed. The list of items considered was meant to be representative rather than exhaustive. It comprised Grocer, Butcher, Chemist, Electrical goods, major items of Clothing, Doctor, Dentist and Bank.

It is not proposed in this paper to dismiss the concept of the range of a good, but this study of consumer movements within a town's area of influ-

<sup>6</sup> B. J. L. Berry, *Geography of market centres and retail distribution*, 1967, p. 64.

ence has underlined some of the difficulties of reconciling theory and reality. For example, the extreme limits of influence for grade 1 towns were found to vary only slightly according to the order of goods or services under consideration, thus for major items of clothing the limit of measurable influence was the 50-minute isochrone and for visits to the doctor it was 30 minutes. For grade 2 towns there was very little variation in the catchment area for each good: in these cases the concept of the range of a good was apparently irrelevant to the hinterland pattern.

Two points arise, therefore, about the validity of considering different goods to have different ranges.

(a) The concept may only apply to higher-order goods which do not appear on the sample list. On the other hand the majority of rural people shop so very infrequently for these higher-order goods (e.g. jewellery, furs, furniture) that to ask them which centres they normally use for such purposes would probably be meaningless.

(b) Journeys to shop cannot be resolved simply into single-purpose trips to the nearest centre which stocks the required good. Rural people, especially the more mobile element, will frequently by-pass the nearest outlet of a required good because they know the same good or service can be obtained more cheaply at a more distant and usually larger town. In particular, it is the multipurpose shopping trip to such larger towns which apparently gives all of the more commonly-required goods and services an identical range in practice.

#### STRUCTURAL COMPONENTS OF THE URBAN HINTERLAND

It has already been suggested that a town's hinterland is not spatially homogeneous, and that in general terms the strength of the rural-urban interaction gradually decays with distance. We can further suggest, along with Golledge,<sup>7</sup> that zonal components of a town's tributary area can be recognised, i.e. an intensive zone, an extensive zone, and a fringe zone, related to increasing distance from the centre and diminishing patronage by rural consumers. Quite understandably, individual town hinterlands differ from one another owing to a variety of local circumstances, but the towns have been aggregated in group 1 and 2 in order to place the emphasis upon the order of the town and the level of the different goods and services rather than upon individual towns.

Figure 6 shows the percentage of people using grade 1 and 2 centres for each good, compared with their distance away from the town in minutes. For the construction of this figure isochrones of travel time were again drawn around each town and the proportion of consumers from within each concentric five-minute band who used the various centres for each good and service was calculated. The three zonal components of the hinterland are defined simply by the two largest discontinuities in the histogram. By this method it would be possible to distinguish a large number of small zones (as many as there are distance bands), but inspection reveals a consistency in the occurrence of two breaks, so, on this evidence and upon Golledge's<sup>8</sup> precedent, three zones were identified.

These zones are as follows:

<sup>7</sup> R. G. Golledge, Conceptualising the market decision process, *J. Reg. Sci.*, 7(1967), Suppl., pp. 239-258.

<sup>8</sup> R. G. Golledge, *op. cit.*

GRADE 1 TOWNS

GRADE 2 TOWNS

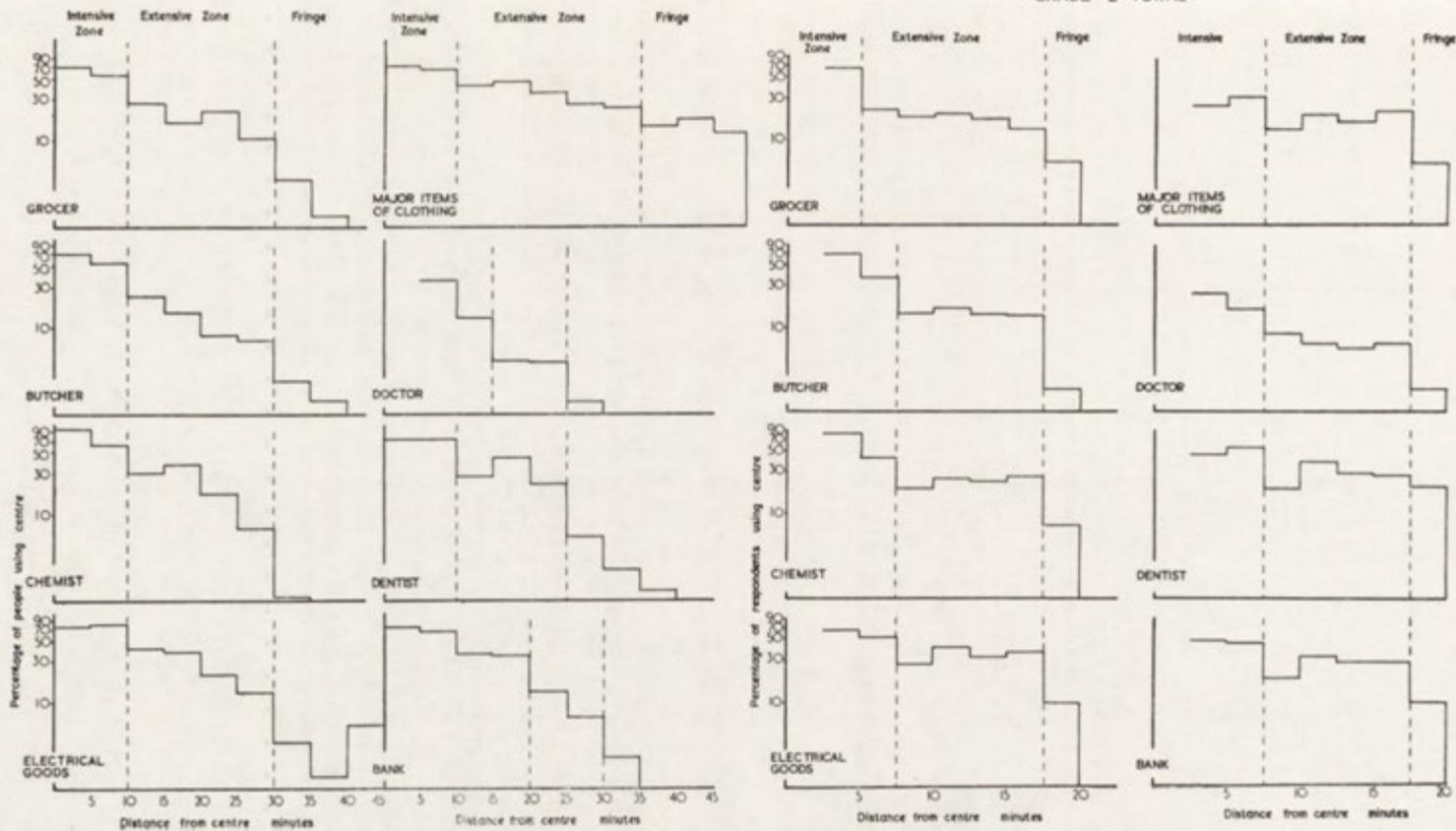


Fig. 6. Zonal components of the shopping hinterlands

(1) *The intensive zone.* Here the influence of the central town was dominant. The extent and intensity of this zone varied more for grade 1 than for grade 2, according to the order of good or service considered. For grade 1 towns the extent varied from the 10-minute isochrone for groceries, to the 20-minute isochrone for banking services, and although the zone characteristically attracted more than 50% of consumers there is competition from suburban and village centres and from towns outside the hinterland area; thus for doctors the proportion of rural people attracted from this zone was less than 50%. The boundary of the intensive zone for grade 2 towns was for all services, but with the exception of groceries a travelling time of 7.5. minutes.

(2) *The extensive zone.* This is a zone where the influence of a town over its rural area is strongly challenged by a centre of similar order, by a town of a higher order, or by a village centre. As Figure 5 shows, in the present case the outer edge of this zone for any good or service is invariably at a time-distance of 17.5 minutes for grade 2 towns, although it ranges from 25–35 minutes for grade 1, according to the good or service considered. Similarly the intensity of a town's influence and its rate of decline with increasing distance varied within this zone: 39% of consumers being normally tied to the central grade 1 town for major items of clothing, but less than 10% for visits to the doctor. For grade 2 towns there is only a relatively weak rural interaction within this zone, the proportion of "tied" consumers never exceeding one third.

(3) *The fringe zone.* This is a narrow band at the outer limits of a town's influence. It is a zone where although the influence of a second town is very strong, a small proportion (usually less than 5%) of consumers continue to use the first town.

We see, therefore, that the hinterland of urban influence exhibits much structural complexity. Even when only a single good or service is being considered the intensity of a town's influence varies throughout its hinterland and components of this variation can be recognized. Although, as a town centre is approached, the proportion of rural people using it for each good grows, the position of complete dominance where the town attracts all of the consumers from a given location is rarely achieved, for some degree of competition from adjacent centres is exerted at all points.

The postulates which have been examined are as follows: —

(1) That for each urban place a boundary can be identified for its area of influence. In fact a boundary in this context will always be a compromise and will obscure the differing intensities with which different parts of the hinterland are linked to the central town. The exponential distance-decay function provides a useful and valid generalisation of the hinterland, but, far from "nesting" together in a regular and mutually exclusive pattern, hinterlands (even of towns of equivalent hierarchical order) overlap extensively.

(2) The concept that different goods and services have different ranges was examined but the evidence in practical terms neither proved nor disproved the theory. Whilst it could be shown (Fig. 6) that for some goods a town commanded a greater hinterland than for others, in many cases, and especially at the lower level of central places, the hinterlands had a similar extent for several different goods. It is suggested that multipurpose shopping trips are an obvious weakness in the concept of the range of a good.

(3) The hinterland of a town is not a uniform space; some parts of it are linked more strongly with the centre than others. This has been illustrated, and, along with Gollidge,<sup>9</sup> we have identified three zones, here termed the intensi-

<sup>9</sup> R. G. Gollidge, *op. cit.*

ve zone, the extensive zone and the fringe, but it should also be noted that each town's hinterland is structurally complex.

(4) That most rural people identify themselves strongly with a single town. Although increasing personal mobility enabled half of the people surveyed to visit more than one town in the month prior to the study, four-fifths of all shopping journeys were made to the respondent's first-choice or premier town. This town was of either grade 1 or grade 2, but second-choice towns were usually centres of higher order than the first choice. Thus the suggested allegiance of rural people to a single town is confirmed.

#### THE MULTIPLE USE OF ALTERNATIVE CENTRES

The irresolute nature of hinterland boundaries and the way in which they vary according to the function being considered means that there is substantial spatial overlap between the zones of influence of adjacent centres of similar rank. A comparison of Figures 4 and 5, for instance, shows that the grade 1 hinterlands completely overlap the grade 2 hinterlands. In behavioural terms, however, the overlap between towns of similar order is more illusory than real. The spatial overlap of the zones of influence of adjacent centres can be conceived as the ability of one town to attract custom from within what is properly considered another town's hinterland.

TABLE 1.

Percentage of respondents who had visited:	
0 towns	6.8
1 town	42.8
2 towns	32.3
3 towns	13.7
3 towns	4.5

Behavioural overlap on the other hand is concerned with the way in which individual consumers distribute their patronage between competing centres and particularly whether they visit two or more towns of the same order. Thus in the area studied spatial overlap was found to be common and indeed inevitable, but behavioural overlap could rarely be demonstrated since only a very small proportion of individual consumers had used two centres of the same rank alternately and indifferently. Therefore a clear pattern of individual consumer loyalty to a particular town emerges but there is no similar straight forward pattern of territorial allegiance.

Table 1 shows that 43% of all respondents had visited only one town in the month prior to the survey, but that 50.4% had visited more than one. This is certainly suggestive of an overlap in the zones of influence of the various towns, but it should be noted that this multiple use of centres is as much complementary as competitive. For example, it was found that only 5.7% of all respondents had visited more than one grade 1 town and that only 7.6% had split their visits between competing grade 2 centres.

A different measure of the way in which a single centre dominates individual consumer movement is gained from a preliminary analysis of the desti-

nation of shopping trips and by calculating the proportion of total shopping journeys which are made to individual towns. In this instance the strength of the ties between a consumer and his/her dominant town is shown by the fact that nearly 80% of all shopping journeys were made to the consumer's premier, or first-choice town (Table 2).

TABLE 2.

Percentage of visits made to:	
premier town	79.0
secondary town	16.6
tertiary town	3.6
others	0.8

Thus although a half of all consumers had visited more than one town, the proportion of visits to towns other than the premier centre was relatively small. Even amongst respondents who had visited more than one town, 71.4% of all visits were made to the "first-choice town" (26% of visits were to a second-choice centre and only 2.6% to third or fourth choices). Nearly three quarters of second-choice visits were made to a centre larger than the premier town, including many to towns outside the area (e.g. Manchester, Birmingham, London). The pattern which emerges is one in which a single town is strongly dominant for each rural person, and although one person in two had visited alternative shopping centres, such visits accounted for only one fifth of all shopping journeys.

## CONCLUSION

This paper has presented the results of a case study of rural-urban interaction as measured by the way in which rural people use urban shopping centres. As such it is a study of consumer behavioural patterns in space; it does not pretend to lay down rules of spatial behaviour. Various postulates on the nature and measurement of urban hinterlands have been examined, and whilst it is not suggested that the detailed exponents and values would be the same in a totally different rural-urban system, there is a likelihood that the general findings would be repeated elsewhere.

In brief, simple maps of urban hinterlands (e.g. the Ordnance Survey "Local Accessibility" map) are merely first approximates to a pattern. They are rather reminiscent of the early maps of Africa that showed only a coastline and ignored the geographical complexities of the unknown interior.

University of Keele

## STRUCTURAL CHANGES OF BIOCOENOSES UNDER THE INFLUENCE OF HUMAN ACTIVITY

ANDRZEJ SAMUEL KOSTROWICKI

### INTRODUCTION

This paper presents selected problems concerning the role and forms of human influence on the biological structure.

In a complicated system of interconnection and interdependence among all the elements of the geographical environment, the biosphere holds a special place. It forms within the geosystem (geographical system) a structural-functional complex of secondary order through which mainly passes the exchange of energy among the other components of the environment. The processes occurring in the biosphere have profoundly changed the structure of the atmosphere, hydrosphere and lithosphere and they have created a new sub-system — the anthroposphere or otherwise the sociosphere. At the same time they have influenced in an essential way the functioning of the whole geosystem.

The biosphere is an extremely complicated formation, differentiated in time and space, dependent on both external and internal factors. Thus the study of the biosphere is extremely difficult. On the one hand knowledge of the functioning of the Earth's ecosystem (ecosphere *sensu latu*). I. Cole [6] requires investigations on the scale of the whole terrestrial globe; on the other hand the structural properties of the biocoenoses imply the regional approach. The understanding of the functioning principles of any partial ecosystem (biogeocoenosis according to V. Sukachev [44]) is impossible without knowledge of the functioning of neighbouring ecosystems. The biosphere forms in fact a continuum; on the other hand it forms a structural mosaic of systems of a strictly defined structure and with sharply distinct limits (J. Braun-Blanquet [4]; H. Ellenberg [9]; J. Schmithüsen [39]; H. Walter [47, 48, 49]). These limits are apparent not only through the changes in the species composition and in the quantitative relations in the respective biocoenoses but also in more subtle features e.g. in the productivity of seeds and their calorific value (K. Falińska [11, 12]) etc.

The numerous detailed studies recently carried out on the structure of biocoenoses validate statements made in biocoenology classics (F. E. Clements and V. E. Shelford [5]; J. Paczowski [35, 37]; V. Sukachev [43], and others). On the other hand they bring into question the opinions of their opponents, especially R. H. Whittaker [50] or T. Kira *et al.* [20], who have endeavoured to perceive also a structural continuum in the biosphere.

Man, by his activity in nature, sharpens the differences between the respec-

tive biocoenoses by creating a mosaic of biological complexes with still more distinct limits and differentiation.

The human influence on living nature is not homogeneous in its kind and cannot be studied as the mean of all its forms. The stress on the biocoenoses and the range of possible changes introduced therein really depend both on the level of the social development of humanity and on the aim which society has set before itself.

A treatment of the totality of the problems of man-biocoenosis interrelations in all their complicated character, and conditioned also by historical and social development, is impossible within one paper. Therefore further consideration will be given to two forms only; agriculture and urbanization. The main stress will be put on the influence of these forms on the structure of the biocoenosis. The problem of their functioning will be mentioned only marginally as the illustrations of the theses presented.

#### CHARACTER OF NATURAL BIOCOENOSIS

As we know from numerous empirical studies, the respective species of plants or animals do not appear in an independent way, but form more or less complicated social complexes. These complexes have arisen as result of the modification of the abiotic environment by the biological material available in various areas of the terrestrial globe (J. Braun-Blanquet [4]). The essential features of the natural biocoenoses are:

(1) Stability of the structure, which means the ability to maintain the thermodynamic balance (L. von Bertalanffy [3]; I. Prigogine and J. Wiame [38]; K. S. Trintcher [45]). At the scale of a single natural biocoenosis it means the tendency to maintain the relative stability of the thermodynamic level. On the other hand, at the scale of the ecosphere, thanks to a continuous evolution, the system of living organisms tends to reduce the entropy in relation to the state which formerly existed, namely to obtain the minimal thermodynamic probability.

(2) Ability to achieve homeostasis of the composition in case its structure has been affected by external factors. This feature has become the basis of the climax theory (F. E. Clements and V. E. Shelford [5]; E. P. Odum [33, 34]).

(3) Ability to create and maintain mechanisms of self-regulation of the matter and energy interchange, both inside the system and between the system and the environment.

(4) Ability to create specific structures within the biocoenoses, revealing themselves both in the harmonious, hierarchical construction and in strictly defined qualitative and quantitative relations between the respective components. This ability permits not only the maximal utilization of creative forces of the environment (N. V. Sukachev [44]), decreases the struggle for survival among the respective components of the biocoenosis (J. Paczosi [36]), but also makes a closed structure of the biocoenosis, to which no new species can be admitted without disturbing its structure.

The above-mentioned properties — thermodynamic stability, homeostasis, self-regulation and the resulting structure — are common to all mature natural biocoenoses, both on land and in water. Living nature can be considered therefore as containing specific social compositions similar in their general aspects to analogous systems of human society.

The evolution of natural biocoenoses is a slow process extending for thousands of years. This results first of all from the homeostatic property of these

systems in that even violent changes cause only temporary effects. After a certain time the damaged biocoenosis regenerates with little trace of the disturbance. The regeneration of a mature complex in a pine forest needs, e.g. in Poland, about 30 years, and a 25-year old elm-ash forest does not differ in its phytosociological aspects from a mature forest. More time — as much as 50–60 years — is necessary for the self-renovation of pine-oak forest and oak-hornbeam forest biocoenosis (A. S. Kostrowicki [28]).

Long-term changes, caused by both natural factors and man, are of essential importance in biocoenosis evolution. They are able to transform profoundly the existing biocoenoses and to create new, unparalleled structures of living nature.

#### INFLUENCE OF AGRICULTURAL LAND-UTILIZATION ON LIVING NATURE

Agriculture is the oldest form of the influence of human societies on living nature seeking consciously to modify nature. The aim of man's activity was first the adaptation of the environment, especially of the vegetation, in order to produce the basic life requirements of local human groups, to secure indispensable quantities of food and to assure relative safety and reproduction possibilities.

With social development the scope of the utilization of the environment by agriculture changed. The forms of interference with nature also changed, with the consequences brought about by its reconstruction not always being favourable to man.

From the biological point of view agricultural activity has as its aim the obtaining of defined production effects by creating new biocoenotic structures. In these compositions, the food chains are maximally reduced and the group of consumers is limited mainly to human society (E. P. Odum [33]; W. C. Allee and others [2]; Ch. S. Elton [10]).

Agriculture has locally caused the destruction of biocoenotic compositions and of their functional properties. The general biomass of the transformed areas has been reduced, while the organic production per year has been increased. Thus, for example, the plant biomass of the natural deciduous forest communities varies in Central Europe (H. Walter [49]) from 350 to 500 t/ha, while for cultivated fields it amounts at present from 10 to 25 t/ha, and for meadows from 15 to 30 t/ha. On the other hand, the biomass increase of dry matter per year in these forests is about 10 to 15 t/ha, while in fields it reaches 20 t/ha.

In anthropogenic biocoenoses (not only in agrocoenoses and pratioenoses, but also in secondary forests) the proportions between the plant biomass and the animal biomass have undergone an essential change. In natural forest areas the latter constitutes from 0.001% to 0.05% of the biomass, while in meadows the share of animal attains 4 to 6% and in fields up to 10%.

As a result of many years of human activity in agriculture, new, totally different biocoenotic structures have arisen, first formed from local species. The share of alien forms, at first not large, has gradually risen. This was not the effect of changes in the agricultural production processes themselves, but was the result of the expansion of cultural contacts, of trade and of exchange between particular countries and continents.

The exchange of floras and faunas and the development of new habitats have become the cause of acceleration of the speciation processes. Through the crossing and coming into contact of previously isolated populations, numerous

new species have arisen, both deliberately created by man and arising in spite of, or even against, his will. For example, during the last century the following new plants have been distinguished: rice-grass (*Spartina townsendi*) from the British Isles, two species of goat's beard (*Tragopogon mirus* and *Tragopogon miscellaneus*) in North America, or the interesting bushy buckwheat (*Fagopyrum suffruticosum*) from Kamchatka and the Kuril Islands (M. G. Agayev [1]). In animal life we have witnessed the rise of a number of new species of moths from the genus *Euxoa*, mainly specialised insect pests of cultivated plants.

In preserved natural biocoenoses human agricultural activities have also left their characteristic impress. First of all the diversity of these communities and also the number of species appearing in them have increased. It has happened as a result of the conscious introduction of a number of species into the primeval vegetation and also as a result of the opening of new means of access for the penetration of alien elements into the given community (e.g. J. B. Falinski [13, 14]).

#### URBANIZATION AND LIVING NATURE

It results from the laws of thermodynamics that the increase of the organization (negative-entropy) of any biological complex is possible only at the cost of introducing a disorganization (growth of entropy) to the other complexes. This fundamental principle also concerns human society.

In the process of social development man's interference with nature has increased, assuming other and varied forms. Its effects are reflected first of all in living nature, although perhaps in relation to living nature they are less dangerous than might at first appear.

The destruction of hitherto existing biocoenotic complexes is not synonymous with the destruction of nature, but with its deep transformation. The new complexes and biocoenotic structures arising under the influence of social processes are also logical, although quite different from those hitherto existing. Already agriculture has formed a number of new biocoenoses, conditioned by the manner of land utilization. These biocoenoses (with the exception of fields) are of a semi-natural character and in principle are subject to the same laws which formed the primary complexes. Urbanization and the whole complex of influences of a technical nature have modified not only the biocoenoses but also the laws controlling them. It can, therefore, be stated that today the natural and anthropogenic ecosystems form two different kinds of nature, governed by different laws and subject to different conditions. It does not mean, however, that in this way a new quality — technospheric or sociospheric — of nature has arisen. The modified and transformed biocoenosis continues to be a formation of nature, although the laws which control it are different from those which modelled its primary image.

Unlike the influences of an agricultural type, transforming the biocoenoses but interfering only to a minimal degree in the totality of the conditions of the environment, urbanization and industrial processes modify mainly the latter. If, therefore, the agrogenic biocoenoses are in a natural way connected with the climax complexes (R. Tüxen [46]), the biocoenoses of urbanized areas are in principle independent from them.

The majority of biocoenoses existing within the range of urban and industrial influences have become unauthentic, labile and subject to continual fluctuations of quantitative and qualitative relationships.

The ease of translocation of organisms through the opening of new migration routes (even by communication lines) leads to the equalization of the variety levels of flora and fauna of urbanized centres. A growing unification, from the biological point of view, of these centres can be observed and it is independent of their situation.

The role of migration elements in the flora and in the fauna of various parts of the world becomes even greater (Ch. S. Elton [10]). For instance, from among nearly 2.5 thousand species of vascular plants appearing in Poland, the coasts of the Mediterranean and the Atlantic, or from North America, these species we meet newcomers from the steppes around the Black Sea, from the coasts of the Mediterranean and the Atlantic, or from North America. They now constitute an integral component of the Polish flora and appear in almost all plant communities.

J. B. Faliński [18] has presented an interesting classification of vegetation from the point of view of the role of neophytes and of the influence of human activity on the formation of contemporary phytocoenoses. This classification may be presented, in general outline, in the following way:

1. Autogenic vegetation — arising under the influence of factors quite independent of man as the primary species combination.

1.1. Primeval vegetation — not showing at all any traces of degeneration caused by human activity.

1.2. Natural vegetation — in which man's influence is not great and deformations introduced by it are similar in character to those caused by natural factors.

1.2.1. Perdochoric vegetation — natural plant community reducing its range in consequence of man's activity.

1.2.2. Auxochoric vegetation — natural plant community extending its range under the influence of human activity.

2. Anthropic vegetation — arising as a secondary species combination under the influence of factors dependent on man.

2.1. Semi-natural vegetation — consisting of local species with a small share of neophytes. Structurally verging upon the natural vegetation, but maintained only in consequence of constructive human activity (e.g. vegetation of meadows and pastures).

2.2. Xencspontaneous vegetation — consisting of new species with a small share of local ones. Structurally verging upon the natural vegetation and arising spontaneously on the natural habitat by supersession of the native species.

2.3. Synanthropic vegetation — consisting of new and local species on sites previously devoid of plant cover as a result of man.

2.3.1. Protosynanthropic vegetation — communities arising most often in spite of man's will, or against his will, on habitats which have been transformed, but which have their counterpart in nature (e.g. field vegetation or vegetation accompanying rural settlements).

2.3.1. Eusynanthropic vegetation — communities arising most often without man's will (sometimes with his will) on habitats which have been extremely transformed and which do not have their counterpart in nature (e.g. the vegetation of urbanized centres, railway tracks, waste-heaps or areas situated within the direct range of chemical substances emitted by industry).

This classification presents a differentiation of vegetation from the phytosociological point of view. It does not, however, take into consideration the reasons which have modelled the community, nor the role of the respective forms of human activities in creating new biocoenoses. This concerns particu-

larly the effects of urbanization and industrialization. These effects may be the result of earth moving (the making of embankments or waste heaps), of the introduction of chemical substances into the soil or atmosphere or, finally, of the deliberate and permanent selection of the species composition, e.g. in parks and lawns in towns. Each of these activities shapes the future biocenosis in a different way and to a high degree defines the possibilities and tendencies of its future development. The treating of the secondary urban vegetation as one eusynanthropic group is, therefore, an over-simplification.

The influence of urbanized centres, especially of industrial centres, on living nature is so great and many-sided that for conditions in which these biocoenoses exist the conception of industrioclimax has been created (J. Wolak [52]).

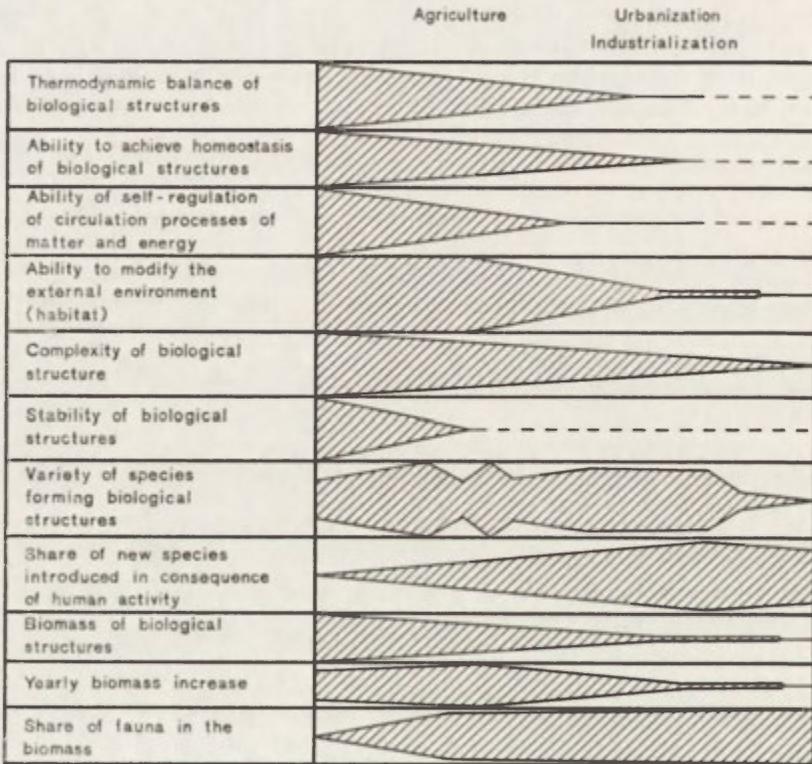


Fig. 1. Pressure on living nature

Urbanized centres, thanks to the existence therein of many habitats consciously or unconsciously formed by man (and in consequence of the introduction of many plant species, especially the decorative species), show in general a rich and varied living nature. In the majority of cases it does not, however, form biocoenotic groupings with an ecologically-defined structure. Usually they are accidental aggregations of short duration, composed of various species. Only where a defined type of activity has been stabilised have primitive social communities of a simplified structure and low productivity been formed. They appear, for instance, around industrial plants emitting substances of a defined chemical composition and on every kind of consolidated waste heap or mound.

The formation of new biocoenoses on radically transformed habitats not having, in general, their counterpart in nature, points to the immense plasticity of living organisms. For instance, the pine decays as a tree in conditions of a strong concentration of sulphur compounds. It can, however, exist very well as a low, trailing shrub. A number of species which normally are hygrophytic, in these conditions appear in mass in even the driest places. Among the insects (e.g. butterflies and moths) specific melanotic forms appear which are better adapted to the new conditions (E. B. Ford [19]).

Essential differences between the selected features of the natural biocoenoses, agrogenic biocoenoses and those which arise in consequence of urbanization processes are shown in Fig. 1.

On the basis of this simple scheme the differences between the natural and anthropogenic biocoenosis and between the effects of agriculture and urbanization activities can be distinguished. These differences point to the necessity of applying different methods in the study of primeval nature and the study of nature as transformed by man. The natural biocoenoses are so stable and the transformations which they undergo are so slow, that in practice they can be treated without historical reference. This allows a contemporary approach. This kind of approach is not suitable for secondary groupings because their present structure depends first of all on the previous conditions and the later state. They should, therefore, be analysed historically. Very often these differences are not noticed and the anthropocoenoses are analysed as if they were durable and stable.

#### THE STATE OF RESEARCH WORK ON THE ANTHROPOGENIZATION OF PLANT COVER IN POLAND

Current research work in Poland on the influence of the human economy on the plant cover has been concentrated on the following problems:

- (1) Registering modifications in the floristic composition occurring under the influence of human activity.
- (2) Examining the anthropogenic vegetation which has arisen as secondary species combinations in agricultural areas, as well as in towns and on communication routes.
- (3) Study of the influence of the anthropogenic vegetation on neighbouring natural plant communities, especially in reservations and National Parks.
- (4) Working out theoretical bases and methods of study for vegetation transformed by man.

Among these problems the most important achievements may be noted in floristic investigations, particularly in the range of changes introduced by man in the Polish flora. The investigations on the synanthropic plants, started before World War II, were considerably widened after the war. There are many floristic monographs of particular towns, such as Poznań (A. Krawiecowa [30]), Gdańsk (Z. Schwarz [40]), Łódź (R. Sowa [42]) and of roads and railway lines (e.g. J. Kornaś, I. Leśniowska, A. Skrzywanek [25]; E. Ćwikliński [7]; Z. Schwarz [41]; A. Krawiecowa [31]). Most of these works are not only floras, but also contain valuable ecological data concerning the adaptation of plants to the new conditions.

Phytosociological investigations have been a little less developed, a result, first of all, of the methodological difficulties which have been previously mentioned. With the exception of grassland communities, the knowledge of which is on a high level in Poland, the associations on other types of agricultural

land and on urbanized and industrial areas, are poorly known and one-sided. Nevertheless in this field distinct progress has recently been noticed. A number of interesting works have appeared concerning the differentiation and the economic role of field weed communities (Z. Wójcik [53, 54]; J. Kornaś [21, 22]; Z. Demianowiczowa [8]; W. Kulpa and F. Pawłowski [32] and others) and the synanthropic vegetation of towns (R. Sowa [42]). Unfortunately, these works take insufficient account of the role of man and of the various aspects of his activity in the formation of the plant communities.

The third trend, dealing with the problems of the anthropogenization of natural communities, started almost sixty years ago, but has only recently developed. Of special importance are the works of J. B. Faliński ([13, 15, 16]), who, by many-sided and modern methods, has analysed the causes and the manner of penetration of new species into the primeval forest of Białowieża (Białowieża National Park). Very interesting results are presented in the works of J. Kornaś and of A. Medwecka-Kornaś [27] concerning the anthropogenization of the natural plant communities of southern Poland. At present investigations on this theme are carried out on a wide scale in the majority of National Parks and in many reservations.

Investigations of a theoretical and methodological character are developing in Poland rather slowly and one-sidedly. In this respect the works of J. Kornaś [e.g. 22, 23, 24], J. Kornaś and A. Medwecka-Kornaś [26], J. B. Faliński [17] and J. Wolak [52] are especially worthy of notice.

Summarising the above considerations it can be stated that, in spite of the existence of a number of varied studies, such an interesting and important problem as the anthropogenization of the biosphere has become the object of scientific interest only to a limited degree. Complex elaborations embracing the mutual relations of the two geographical systems—human society and living nature—in a more intense way are lacking. The problem of the influence of urbanization and industrialization on biocoenoses and the problems involved therein and pertaining to the bio-sanitary, recreational and productive role of the plant cover have so far not been treated in Poland in a scientific way at all.

The working out of models of mutual relations between these systems and between them and the remaining components of the geographical environment and the choice of suitable investigation methods are required to explain the essence of the phenomena and the effect of the anthropogenization of the biosphere in its structural and functional aspects.

Institute of Geography PAN, Warsaw

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## LEISURE MOTORING IN GREAT BRITAIN: PATTERNS AND POLICIES

JOHN M. HALL

### INTRODUCTION

"Transhumance is nowadays an urban rather than a pastoral way of life" states Gottman.<sup>1</sup> Thus transhumance in Great Britain is no longer an oscillation in the vertical plane; it is a horizontal movement of people from their homes at the weekends, and especially in the summer, to the seaside and countryside. It is the motor car which leads the "get-away" people to gaze and graze (picnic) in the open air, but so often the townfolk congregate at the same beauty spots, beaches, historic houses and lake-sides, and they may thereby destroy the peace, charm and solitude of the countryside which attracted them in the first place.

As both real income and personal leisure-time increase, so more people will buy more cars and use them more often on leisure journeys. Household expenditure on buying and running motor cars and motor cycles represented 5.6% of all consumers' expenditure in the United Kingdom in 1959, and 8.0% in 1969.<sup>2</sup> Spending on food decreased from 26% to 21% in the same period. There are at present wide variations in car ownership throughout the country: while many counties in the Midlands and South (Worcestershire, Oxfordshire, Surrey, Hampshire) will average two cars for every five people in the mid-1970s, it seems that many northern urban communities (Manchester, Teesside, Clydeside) will attain only half that rate.<sup>3</sup> But forecasting ownership is difficult. In Figure 1 Tanner's estimate for 1980 is 19m cars on Britain's roads but, by relating car ownership to the life-cycle, the future age-composition and disposable income of different socio-economic groups within the population, Abrams<sup>4</sup> suggested that 17m cars by 1981 was a more reasonable

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<sup>1</sup> J. Gottmann, Environment and ways of life in the modern metropolis, in: J. W. House (ed.), *Northern geographical essays in honour of G. H. J. Daysh*, Newcastle upon Tyne, Oriel Press, 1966.

<sup>2</sup> Central Statistical Office, *Annual Abstract of Statistics, 1970* (London, H.M.S.O., 1970), Table 311.

<sup>3</sup> P. G. Herrman, *Forecasts of vehicle ownership in counties and county boroughs in Great Britain* (Crowthorne, Road Research Laboratory Report LR200, 1968).

<sup>4</sup> M. Abrams, *Trends in car ownership and leisure*, paper delivered to British Road Federation Conference on Roads and Leisure, University of Keele, 13-16 July, 1970.

prognostication. Assumptions about the future growth of leisure-time are equally questionable, for average actual working hours still remain fairly constant at 47 hours<sup>5</sup> despite a fall in the basic working week from 48 hours in the 1920s, to 44 hours in the late 1940s, and 40 hours nowadays. Nevertheless, car ownership and use are increasing, and the observable effects of car penetration in city centres—parking restrictions, one-way streets, impediments to pedestrians and thwarted public services—may spread to Britain's countryside.

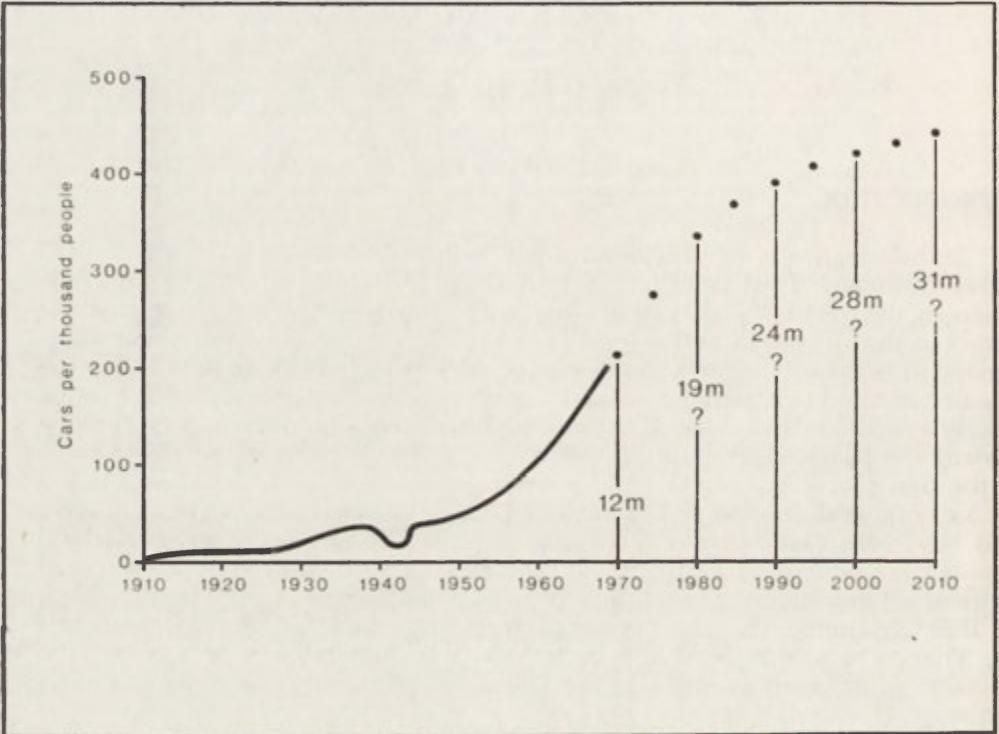


Fig. 1. The growth of car ownership in Great Britain

Source: Tanner, J. C., Trends in car ownership and traffic flow, paper presented to British Road Federation Conference on Roads and Leisure, University of Keele, 13-16 July, 1970

#### SPATIAL AND TEMPORAL PATTERNS OF LEISURE MOTORING

Where and when do people go on outings in their cars? Many townfolk head for the ten National Parks of England and Wales, which, occupying 5258 sq. miles (13,618 km<sup>2</sup>), i.e. nine per cent, of the two countries, are at the apex of the hierarchy of outdoor "resource-based" recreation facilities (Fig. 2). The title National Park is a misnomer in some respects, for the land is not nationalized, being mainly in private ownership; nor is it parkland, being

<sup>5</sup> National Board for Prices and Incomes, *Hours of work, overtime and shiftworking*, Report No. 161 (London, H.M.S.O., Cmnd. 4554, and suppl. 4554/1, 1970).

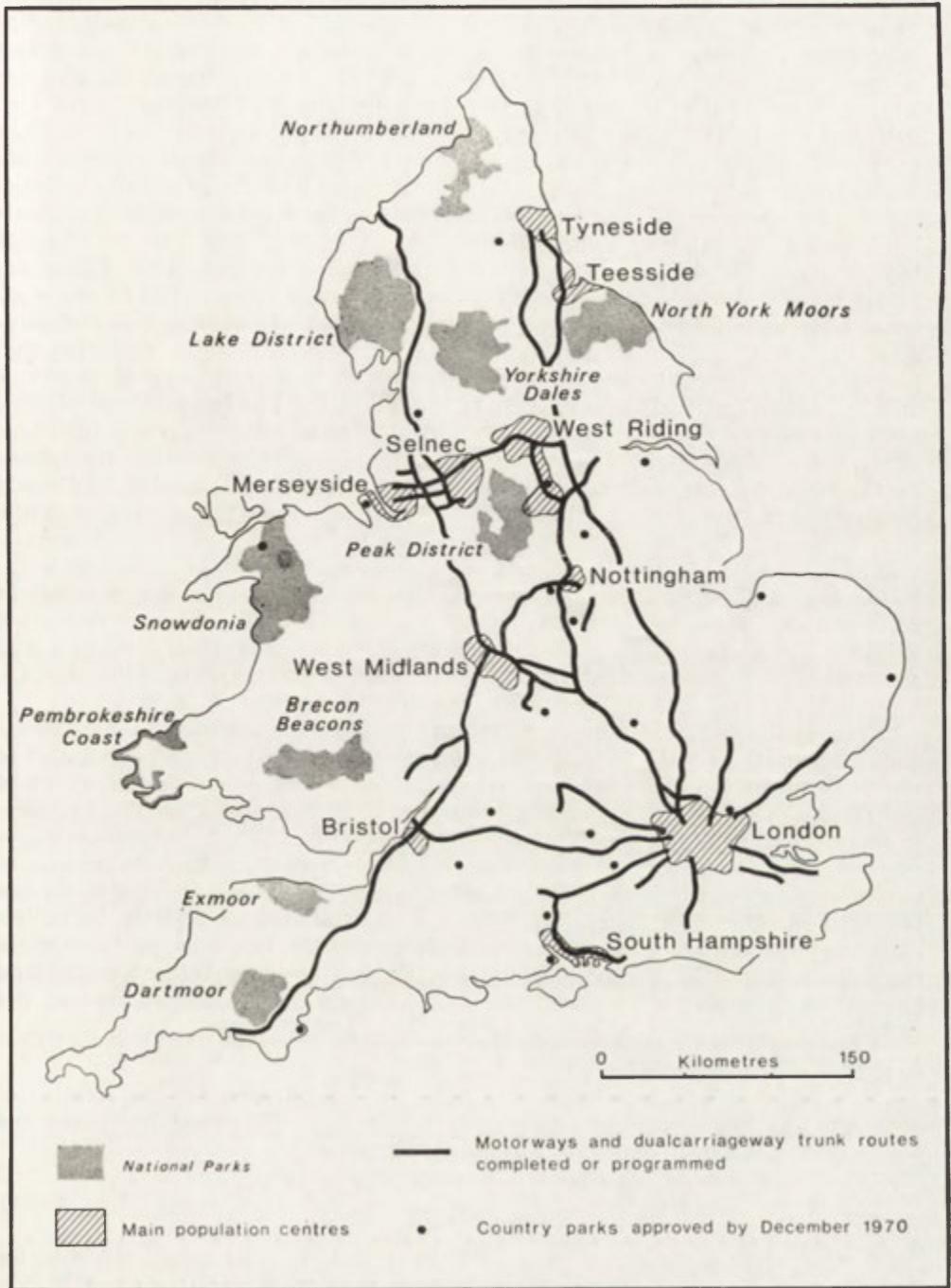


Fig. 2. Centres of population, motorways and National Parks in England and Wales  
 Sources: Ministry of Transport, *Roads for the future: the new inter-urban plan for England*, (London: H.M.S.O., Cmnd. 4369, 1970); *Recreation News* No. 25, Dec. 1970 (London: Countryside Commission).

farmed and forested and also used for water-gathering. Parks have been designated to conserve and enhance the natural beauty within their bounds, and to promote access to, and enjoyment of, these areas by the public.<sup>6</sup> Since 1968 a new type of national outdoor recreation site is being designated: the Country Park. Sites are being chosen so as to reduce the length of the journey for conurbation residents, to ease the pressure on remote places, and "to reduce the physical and aesthetic risk of damage to the countryside which often comes when people just settle down as and when it suits them".<sup>7</sup> In Scotland, National Forest Parks fulfil many of the functions of National Parks, and in Northern Ireland it is hoped that National Parks will be designated according to the provisions of the Amenity Lands Act (Northern Ireland), 1965. Other national attractions include properties — scenic areas or historic houses — owned by the National Trust or private owners. One such owner, the Duke of Bedford, has added the fun of the fair to his Woburn Abbey estate, declaring that 'being a showman is more fun than sitting about in dignity or potting pheasants'.<sup>8</sup> Castles and earthworks, such as the Tower of London and Stonehenge, are protected by the Ministry of Public Buildings and Works (since 1970 part of the Department of the Environment). National nature reserves are managed by the Nature Conservancy, and local nature reserves are protected by County Naturalists' Trusts. Additionally, the nine regional Sports Councils of England, and those of Wales and Scotland, have compiled inventories of golf courses, swimming pools, playing fields and other 'user-oriented' facilities, and a kaleidoscopic pattern of ephemeral spectacles, fairs, pageants and regattas is recorded and advertised by the British Tourist Authority. Finally one must mention the varied scenery of Britain, for a varied geological structure and a selection of geomorphological processes, and a sequence of invading groups, have left physical and cultural relief features of varying durability.

Each of these features has a different "pull" or attraction, and a different clientèle, related partly to its position in the recreation hierarchy, and also to the distance between the facility and major centres of population. Surveys of the journey-to-leisure are much more difficult to organize than the journey-to-work, because for many motorists the journey itself is the "recreation experience" (unwelcome jargon) and there may be no one specific destination to which people drive.<sup>9</sup> So "leisure motoring" embraces both journeys to leisure facilities and journeys for pleasure. Data about the purpose and timing of leisure journeys are often a coincidental by-product of other surveys,<sup>10</sup> and more investigations should be made at a sub-regional scale to relate on-site and household surveys, as has been done in Lanarkshire.<sup>11</sup> More studies of the

<sup>6</sup> *National Parks and Access to the Countryside Act*, 1949, 12, 13 and 14 Geo. 6. c. 97.

<sup>7</sup> *Countryside Act*, 1968, 16 and 17 Eliz. 2. c. 41., allowed for the creation of country parks, the purpose of which is explained in: *Policy on country parks and picnic sites* (London, Countryside Commission, 1969), p. 2.

<sup>8</sup> D. Sutherland, *The landowners*, London, Blond, 1968, p. 72.

<sup>9</sup> N. W. Mansfield, Recreational trip generation, *J. Transp. Econ. Policy*, 3(1969), 152-164.

<sup>10</sup> P. G. Gray, *Private motoring in England and Wales* (London, H.M.S.O. for Government Social Survey, 1969); K. Sillitoe, *Planning for leisure* (London, H.M.S.O., for Government Social Survey, 1969).

<sup>11</sup> B. S. Duffield and M. L. Owen, *Leisure + countryside = a geographical appraisal of countryside recreation in Lanarkshire* (J. T. Coppock, ed.), Edinburgh, Department of Geography, University of Edinburgh, 1970.

before-and-after variety<sup>12</sup> might indicate the possible consequences of highway improvement and motorway construction on the relative accessibility of different national parks and leisure facilities.

The temporal concentration of leisure trips of all kinds can best be described in graph form (Figs. 3A and 3B). Notice that the bimodal pattern of traffic flow, so typical of work-days, is replaced by a unimodal curve which shows the build-up of traffic on the journey-from-leisure outings on a Sunday evening. Sunday is undoubtedly the most popular day for leisure trips (Fig. 3C), but is it worthwhile paying for traffic regulation mechanisms which would be used on one afternoon each week for, say, six months a year?

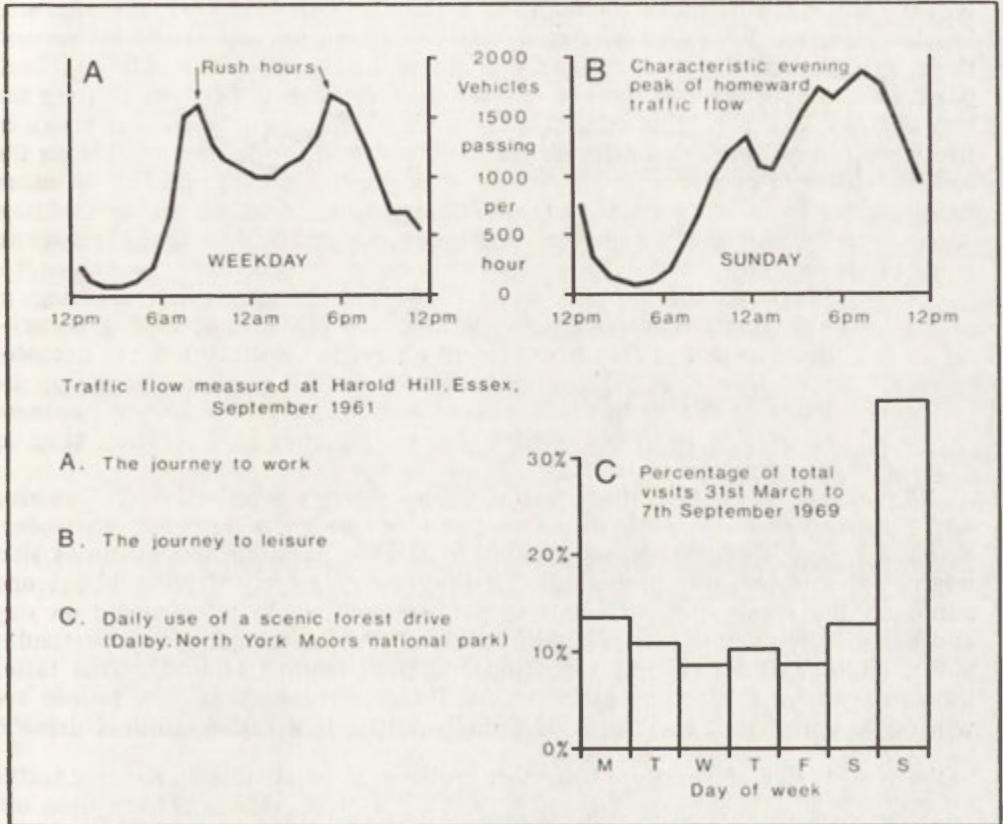


Fig. 3. The timing of work- and leisure-journeys compared

Sources: A and B from Cracknell, B., Accessibility to the countryside as a factor in planning Yorkshire North Riding

BEHAVIOURAL AND PERCEPTIONAL PATTERNS OF LEISURE MOTORING

Why do people enjoy driving for pleasure, how do they choose a particular route, and what do they do, or want to do, along their route? It is difficult to

<sup>12</sup> Leeds University, Centre for Transport Studies, began in 1968 before-and-after study of the influence of the M62 trans-Pennine motorway on road and rail traffic

write anything sensible about why people drive about, but in their study of the English landscape, Lowenthal and Prince<sup>13</sup> have observed that "Climate and morality are twin spurs to activity, constant encouragements to be up and about." If motivation proves elusive, there are at least records of who goes where. Furnidge<sup>14</sup> reported that few teenagers are found in the countryside in Sussex: they prefer the seaside. Young, unmarried people have the highest participation rates in urbanbased sports and recreations, and if they are found in the countryside they are often on horseback or walking — not passively cruising in a car. Rodgers suggests that as car ownership spreads, so the stage in the life-cycle will become a better predictive tool of a person's leisure habits than the currently-favoured measures of socio-economic status<sup>15</sup> If late-teenage marriage becomes common, then the early middle ages, the 40s, will be characterized by golf, boating, second-home owning and moorland recreations, rather than the present family visits to the coast, countryside and local park. It also appears that the use of cars changes with the length of time the owner has had a car. "For most families", writes Rodgers, "a critical break in life style follows the acquisition of the first car, and the impact of this on the use of leisure is probably greater than on any other aspect of life." In other words, a car enables a person to reach otherwise inaccessible leisure facilities with ease. But for many families, running a car deflects financial resources from expensive pursuits to cheaper countryside activities. Rodgers writes:<sup>16</sup>

"Perhaps the simple 'going for a drive' — in which arriving at a destination is less the motive than the pleasure of getting there — is an aspect of the 'honeymoon' phase in a society not yet accustomed to seeing the car as a mere beast of burden. Certainly, the longer a family has had a car, the more purposive its use becomes, so that its influence is that of a recreational tool ... rather than as a recreation in itself."

So many people are, in the words of Chuck Berry's song of 1964,<sup>17</sup> "cruising and playing the radio, with no particular place to go". Expressed more formally by Yapp, "Some visitors indulge in all the pursuits and pastimes that might be expected, but predominantly they enjoy merely driving about and admiring the scenery".<sup>18</sup> Although 48 per cent of people interviewed on day and half-day trips in the Lake District National Park were going to a particular place, another 43.5 per cent were indeed "just driving around". This latter figure may be a misleading estimate, for Rodgers thinks that 'few people are willing to admit that their idea of a day's outing is a rather aimless drive'.<sup>19</sup>

in the West Riding of Yorkshire (Director: Professor K. M. Gwilliam). Existing traffic generation and flow have been measured, and a model of projected future trips will be compared with the actual pattern of movement in the mid-1970s.

<sup>13</sup> D. Lowenthal and H. C. Prince, *The English landscape*, *Geogr. Rev.*, 54(1964), 309–346.

<sup>14</sup> J. Furnidge, *Planning for recreation in the countryside*, *J. Tn Plann. Inst.*, 55(1969), 62–67.

<sup>15</sup> H. B. Rodgers, *Leisure and recreation*, in: P. Cowan (ed.), *Developing patterns of urbanisation*, Edinburgh, Oliver and Boyd, 1970.

<sup>16</sup> H. B. Rodgers, *The Pilot National Recreation Survey* (London, British Tourist Association — Keele University, 1967).

<sup>17</sup> Chuck Berry, *No particular place to go* (London, copyright held in U. K. by Jewel Music Publishing Company Ltd., 1964).

<sup>18</sup> W. B. Yapp, *The weekend motorist in the Lake District* (London, H.M.S.O., 1969).

<sup>19</sup> H. B. Rodgers, *op. cit.*, (1967).

Notice again that some people have a specific destination in mind, others are touring around for pleasure.

Do groups follow the same route on their return journey as on the outward section of their trip? Duffell and Goodall<sup>20</sup> found that 55 per cent of their sample of parked motorists returned by their outward route. This contradicts Colenutt's surmising about a demand-predictive model of recreational trips to the Forest of Dean,<sup>21</sup>

"It would appear ... that the objective of the tripper is not to minimize travel time between the origin and a single destination, but to maximize the recreational benefit he can obtain from both travel time and the time spent at stopping points. Consequently we would expect trippers to maximize the variety of the trip by minimizing the number of miles that are duplicated and be indifferent to the shortest route unless it was also the most scenic."

With respect to the duration of journeys, it appears that speed is not the essence of pleasure journeys, even if motorists undertake journeys to leisure facilities with morning-rush-hour bravado. Duffell and Goodall<sup>22</sup> related the demand of recreation experience to travel time, whereas Clawson and Knetsch<sup>23</sup> preferred to examine the total travel costs of American car-borne visitors. For many people cost- and time-considerations restrict the choice of a route less than the sheer effort of launching the children and picnic into the car and along the route.

Once the leisure motorists nose along the roads, the car and its occupants begin to affect their surroundings. Impacts are recorded on Figure 4 under four headings, the most apparent of which is ecological, for "rain plus cars plus green verges" equals "brown verges". Several workers have studied the erosive effects of visitors in the countryside.<sup>24</sup> Other physical blows attending the weekend transhumance include noise, fumes, unsightliness and the colourful, malodorous litter, which lingers after motorists' visits: in the New Forest this exceeds 800 tonnes a year. Few studies have yet explored the economic impact of leisure motorists, for unless one investigates islands or easily-monitored valleys, it is difficult to delimit the geographical bounds of this impact. Similarly, work is lacking on the attitudes of country residents to the invasions by

<sup>20</sup> J. R. Duffell and G. R. Goodall, Worcestershire and Staffordshire Recreational Survey 1966 — Use of the motor car for leisure purposes, *J. Tn Plann. Inst.*, 55(1969), 16–23.

<sup>21</sup> R. J. Colenutt, Modelling travel patterns of day visitors to the countryside, *Area* (1969), 43–47.

<sup>22</sup> J. R. Duffell and G. R. Goodall, *op. cit.*

<sup>23</sup> M. Clawson and J. L. Knetsch, *Economics of outdoor recreation*, Baltimore, Johns Hopkins, 1966.

<sup>24</sup> F. B. Goldsmith, R. J. C. Munton and A. Warren, The impact of recreation on the ecology and amenity of semi-natural areas: methods of investigation used in the Isles of Scilly, *Biol. J. Linnean Soc.*, 2(1970), 287–306; R. J. Lloyd, *Countryside recreation, the ecological implications* (Lincoln, Lindsey County Council, 1970); R. L. Reynolds and J. Sankey, Public pressures on nature reserves and S.S.S.I's near large urban areas in Surrey, in: E. Duffey (ed.), *The biotic effects of public pressures on the environment* (Monks Wood, Nature Conservancy, 1967); J. M. Schofield, Human impact on the fauna, flora and natural features of Gibraltar Point, in: E. Duffey (ed.), *The biotic effects of public pressures on the environment* (Monks Wood, Nature Conservancy, 1967).

*Homo motorens*. Newspaper headlines indicate a tension, or at least differing interests, as between countryfolk and townsfolk: "One-way plan alarms farmers" (*Guardian*, 29 Jan. 1968) and "Lakes fear for solitude" (*The Times*, 18 Nov. 1969), "Townsmen's rush spoils the peace" (*Guardian*, 12 June 1969) and "Countrymen out to stay that way" (*Guardian*, 15 Nov. 1969). These shorthand slogans show that the new mobility may not always be welcomed by the old nobility and gentility. And besides individuals, there are groups — the Council for the Protection of Rural England, Country Landowners' Association, Friends of the Lake District, National Farmers' Union among others — who bring pressure on the County Council countryside committees which modify and adopt rural recreation plans.

TABLE 1. Activities of Groups in Yorkshire Dales National Park

Activity	Group type					Total	Rank
	small adult	large adult	small family	large family	other		
Picnicking	25	26	49	25	13	138	2
Hiking	4	—	1	1	1	7	9
Strolling	70	58	66	33	13	240	1
Playing games	1	1	17	20	3	42	4
Sitting	34	21	12	10	—	77	3
Drinking	10	3	3	1	3	20	7
Eating indoors	8	3	7	3	1	22	6
Visiting special attractions	9	11	11	2	4	37	5
Other	—	1	4	4	1	10	8
Total	161	124	170	99	39	593	—

Source: Derived from N. N. Fraser and N. B. E. Ayling, *Recreation traffic in the Yorkshire dales*, 1969.

What do motoring groups actually do? After a survey of recreation on commons — another misnomer, for land is not communally owned, rather rights of access are exercised by some people in common — Wager stated that 'many people are seeking a visual rather than a physical contact with the countryside'.<sup>25</sup> This may mean sitting in the car on a hot summer's day, with the windows closed and an umbrella unfurled to mask the sun! In their survey of parked motorists,<sup>26</sup> Duffell and Goodall found that people in over one-third of the car groups had picnics, and almost two-thirds took a walk, albeit short. Similarly Table 1 shows strolling and picnicking to be the most popular activity of groups observed in the Yorkshire Dales National Park traffic survey. When parked, the car becomes a support vehicle, as Burton noticed at Box Hill: <sup>27</sup> "The car is an extension of the house. It is a room which can, in effect, be detached and moved away from the home environment while retaining many of the latter's important functions." Wager enumerated some of these func-

<sup>25</sup> J. F. Wager, Outdoor recreation on common land, *J. Tn Plann. Inst.*, 53(1967), 398-403.

<sup>26</sup> J. R. Duffell and G. R. Goodall, *op. cit.*

<sup>27</sup> T. L. Burton, A day in the country, *Chart. Surv.*, 98(1969), 378-380.

tions: "picnic hamper, carry-cot and rucksack all in one".<sup>28</sup> Those without a garden at home can transplant the car within the national garden that is the British countryside. Only the toilet is lacking, and this is the facility which is most in demand from questionnaire respondents.<sup>29</sup>

#### LAND- AND ROAD- MANAGEMENT POLICIES FOR LEISURE MOTORING

Given that large gatherings of cars at certain beauty spots on Sundays may be unacceptable, how might leisure traffic be regulated in the countryside? Considerations of capacity, environment and accessibility were the main ingredients of the Buchanan report on "Traffic in Towns",<sup>30</sup> and are equally appropriate for examining cars in the countryside. As the quantity of rural traffic increases, so the quality of the environment may deteriorate. But super-highways, which might be acceptable to keep traffic moving in cities, are often out of scale with the subtleties of texture, tone, bird voice and animal life which the countryside offers the townsman.

What are the thresholds above which the car becomes a 'monster of great potential destructiveness'? Apart from *Planning for Amenity and Tourism*,<sup>31</sup> there have been few attempts to quantify the capacity of roads to absorb leisure motorists although Houghton-Evans and Miles<sup>32</sup> have summarized recent work on capacity. Here, however, is one of the main research gaps in leisure motoring research; and when are psychological, as well as physical and ecological, capacities exceeded?

Perhaps the key to reconciling the conflict between environment and accessibility lies with the extension of parking facilities in the countryside. Traffic flows are reduced where cars line the roadside, and erosion is hastened on susceptible verges. To counteract this, parking places should be provided. They need not be elaborate or obtrusive; but by careful design rather than prohibitions it should be possible to direct the motorist away from vulnerable localities. Parking standards are well-established in towns; should not different countryside facilities — castles, beaches, reservoirs — be assessed for the area of hard-standing appropriate to the number of visitors?

Here is an effective means of restraining motorists in vulnerable areas; when car parks are full the motorist has to drive elsewhere for his Sunday afternoon jaunt. Rodgers<sup>33</sup> has entitled this method of metering demand 'the valve'. Motorists can also be discouraged from penetrating certain areas by leaving steep gradients, fearsome bends and rough-surfaced roads. A lack of signposting, gated roads and fords can all help in what Brancher<sup>34</sup> has

<sup>28</sup> J. F. Wager, *op. cit.*

<sup>29</sup> Automobile Association, *The motorist today* (London, Automobile Association, 1966); T. L. Burton, *Windsor Great Park, a recreation study* (Wye College, Department of Economics, Studies in Rural Land Use, No. 8, 1967).

<sup>30</sup> C. D. Buchanan, *Traffic in towns*, Report of the Working Group (London, H.M.S.O., 1963).

<sup>31</sup> An Foras Forbartha (National Institute for Physical Planning and Construction Research), *Planning for Amenity and Tourism* (Dublin, An Foras Forbartha, 1966).

<sup>32</sup> W. Houghton-Evans and J. C. Miles, Week-end recreational motoring in the countryside, *J. Tn Plann. Inst.*, 56(1970), 392-397, and Environmental capacity in rural recreation areas, *J. Tn Plann. Inst.*, 56(1970), 423-427.

<sup>33</sup> H. B. Rodgers, *op. cit.* (1970).

<sup>34</sup> D. M. Brancher, Scenery, roads, cars and costs, paper delivered to Council for

called 'effort pricing'. Alternatively cars could be prohibited from certain areas, as they are in some French and German national parks — although these 'parks' function as nature reserves. Broughton *et al.*<sup>35</sup> foresee tourists in the Lake District being offered "full board and the use of private motor car". Car-borne day trippers might be zoned out of certain popular areas — or 'honey pots' as they are now whimsically called. As a refinement of zoning, the car-trip party may be required to park their vehicle and continue to their destination by feet, or minibus, as has already started in the deftly conceived and much-publicized Goyt Valley Experiment in the Peak District National Park.<sup>36</sup> Cars are excluded from the valley on summer weekends so that passengers may walk around the Fernilee and Errwood reservoirs in peace, or catch the free minibus to their favourite beauty spot. The remaining 'physical restraint' shown on Figure 4\* involves the conscious planning of the hierarchy of demand for facilities. Suitably placed "honey pots", such as country parks close to conurbations, can relieve pressure on the remoter areas.

Other means of controlling car penetration include charging for using certain roads, or car parks, and the more acceptable, but hitherto untried, possibilities of publicity. The Joint Schools Survey<sup>37</sup> of "People at play in Dartmoor" listed three possibilities for regulating future demand. First, the *status quo* could be maintained in terms of road networks and publicity, leading to more congestion with increasing car ownership. Secondly, the information available to actual and potential leisure-seekers could be held constant and roads improved. Thirdly, and of interest here, the road framework could be preserved and levels of information varied to prevent overcrowding in certain areas. There is room for experiment here, particularly to measure the effect of publicity on the popularity and use of different places and routes. Fraser and Ayling<sup>38</sup> foresee such methods being used in the Yorkshire Dales: information, interpretation and wardening services will be used to manage pressure 'in such a way as to avoid overloading ... Operationally this will involve ... the use of peak period notice boards and direction signs, route itineraries and other information management methods.'

After the channelling of the motorist to some 'acceptable' locality some attempt may be made to make him forsake his car. Otherwise, in the words of Esther Moir, we shall find that 'the discovery [of Britain] has been made, and that all-embracing curiosity of the earlier tourists has given place to pleasant family expeditions to well-known haunts and carefully preserved beauty spots'.<sup>39</sup> It is difficult to be curious when inside a car, and Appleyard,

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the Protection of Rural Wales *Third Annual Study Conference*, Aberystwyth, 11–12 April, 1969.

<sup>35</sup> F. L. Broughton, U. Aylmer Coates, J. Drake, J. McInnes, K. Steen and W. R. Wark, *Report on traffic in the Lake District National Park* (Kendal, Westmorland County Council, for Lake District Planning Board, 1965).

<sup>36</sup> T. Burrell, Car and country, *Town Ctry Plann.*, 38(1970), 327–330.

<sup>37</sup> Joint School Survey, People at play in Dartmoor National Park, *Geogr. Mag.*, 42(1970), 266–279.

<sup>38</sup> L. N. Fraser and N. B. E. Ayling, *Recreation traffic in the Yorkshire dales* (Wakefield, West Riding County Council; Northallerton, North Riding County Council, 1969).

<sup>39</sup> E. Meir, *The discovery of Britain: the English tourists, 1540–1840*, London, Routledge and Kegan Paul, 1964.

\* Figure 4 at the end of the book.

Lynch and Meyer<sup>40</sup> complain that cars dilute sounds, smells, touch and the weather, and mask vision.

The Royal Touring Club of the Netherlands (ANWB) began a series of 'Ride to Walk' pamphlets in 1960, the idea being to encourage the motorist to drive to an area, get out of his car, and enjoy a marked walking circuit of one to two hours' duration. Guides to 'way marked walks' have now been produced in Exmoor National Park, and two *Countryside Trails by Car* in that park have been publicised by Somerset County Council.<sup>41</sup> Motorists follow a circuit of 46 or 70 miles (74 or 112 km) and alight at various laybys and view points, and link 'landscape and nature notes' with observation. Nature trails in forests and on lake littorals abound in the Lake District National Park, and the Forestry Commission also have considerable experience of designing trails in the North York Moors and Northumberland National Parks. At Reeth, in Swaledale, the Northern Dales Building Trust has produced *A guided walk round the buildings of Reeth*,<sup>42</sup> which extends the principle of the nature trail to village architecture, and the market place easily doubles as a car park on Sundays. Furnidge<sup>43</sup> has reminded us, however, that facilities should also be provided for family groups with young children and older people seeking quiet enjoyment of the countryside. Ideas for fulfilling their requirements are amply described by Elisabeth Beazley.<sup>44</sup>

#### SCENIC ROUTES

Several of the mechanisms described above for relieving congestion and introducing the motorist to rural habits and habitats can usefully be combined in scenic routes and scenic drives. A distinction can be made between routes, using existing roads of high scenic value, and shorter drives designed or converted especially for the leisure motorist — perhaps through forests, along the coast, or atop mountain ridges. But we shall neglect drives in this discussion, for they have been described by the Countryside Commission.<sup>45</sup>

Scenic routes would traverse existing 'non-principal county roads' (which before 1967 were known as 'unclassified' roads) and physical improvement would be restricted to roadside facilities: parking, view points, signposted walks, toilets, picnic sites, natural history and landscape information. The road itself would not be changed in alignment or design speed — for most of the week and year it carries only local business and social traffic. Certainly, the attraction of much of the non-principal roads — 93,000 (149,000 km) out of the 171,000 mile (274,000 km) public highway network in England and Wales — is due in large measure, according to Haythornthwaite:<sup>46</sup>

<sup>40</sup> D. Appleyard, K. Lynch and J. R. Meyer, The view from the road, in: D. Lowenthal (ed.), *Environmental perception and behavior* (University of Chicago, Department of Geography Research Paper 109, 1967).

<sup>41</sup> Somerset Country Council, *Countryside trails by car* (Taunton, Somerset County Council, 1970).

<sup>42</sup> Northern Dales Building Trust, *A guided walk round the buildings of Reeth* (Kendal, Northern Dales Building Trust, 1968).

<sup>43</sup> J. Furnidge, op. cit.

<sup>44</sup> E. Beazley, *Designed for recreation*, London, Faber and Faber, 1969.

<sup>45</sup> Countryside Commission, *Scenic Drive Survey: Dovey and Gwydyr Forests, July 1969* (London, Countryside Commission, 1970).

<sup>46</sup> G. Haythornthwaite, Prescription from a National Park, *J. Inst. Highway Engrs*, 17(1970), 13–18.

“... to their complete integration with the countryside and the abundance of local incidents which may seem illogical to the highway engineer. Steep gradients, sharp bends, trees overhanging the road, narrow bridges, all provide fresh interest along the way and induce low speeds.”

Brancher<sup>47</sup> has noticed that it is such “illogicalities” which rapidly disappear during conventional road improvement. They should be preserved, not destroyed.

Two types of scenic route can be envisaged: the one thematic, the other to act as a link. Thematic routes would connect castles, or prehistoric sites, or churches, or industrial monuments, or perhaps literary shrines, or—more often—just pretty villages with tea shops and toilets.<sup>48</sup> Link routes would be created to relieve congestion on the principal routes to national parks and the seaside, and might run in parallel from conurbations.

Notice the frequent use of “might” and “would”, although the need for the special treatment of scenic routes in national parks was recognised in the Report of the National Parks Committee (Hobhouse Report) in 1947. We read in that report<sup>49</sup> that the committee

“... would emphasise again that it must be one of the essential duties of the National Parks Commission, in co-operation with highway authorities, to ensure that roads in National Parks provide for the convenience and enjoyment of motorists—the necessary view points, sidings, and parking places on all scenic roads and in places of popular resort.” (para. 212)

Only now (1970) is the spirit of the Hobhouse proposals beginning to percolate to countryside planners in the United Kingdom although scenic highways are well established in the United States.<sup>50</sup>

Since the Town and Country Planning Act, 1968, planners have been required to include traffic management schemes in their urban “structure-plans.” In a few years’ time it will surely not be uncommon for rural plans to include scenic routes and corridors, and suggestions about peak-period leisure traffic management. A study of the East Hampshire Area of Outstanding Natural Beauty<sup>51</sup> showed how the interests of farmer, forester, tourist and resident could be safeguarded in the production of a rural structure plan which also allowed for the creation of scenic routes.

Existing scenic routes are invariably unrelated to wider planning aims. The Antrim coast road in Northern Ireland is a spectacular scenic route *de facto*, but not *de jure*, and, like the nearby signposted Ballymoney scenic route, is deserving of wider publicity. In mid-Wales the Central Electricity Generating Board has opened the access road from Ponterwyd to Talybont, so that it can

<sup>47</sup> D. M. Brancher, Traffic in scenic areas—the user-road relationship, *J. Tn Plann. Inst.*, 54(1968), 271–274.

<sup>48</sup> P. Hall, The Great British history parkway drive-in, *New Society*, 3 Aug. 1967, 151–155.

<sup>49</sup> Sir Arthur Hobhouse, *Report of the National Parks Committee*, Chairman: Sir Arthur Hobhouse (London, H.M.S.O., Cmnd. 7121, 1947).

<sup>50</sup> Land Use Consultants, *Parkways in principle and practice* (London, Land Use Consultants, 1967).

<sup>51</sup> Hampshire County Council et al., *East Hampshire A.O.N.B.* (Area of Outstanding Natural Beauty). *A Study in Countryside Conservation* (Winchester, Hampshire County Council, 1968).

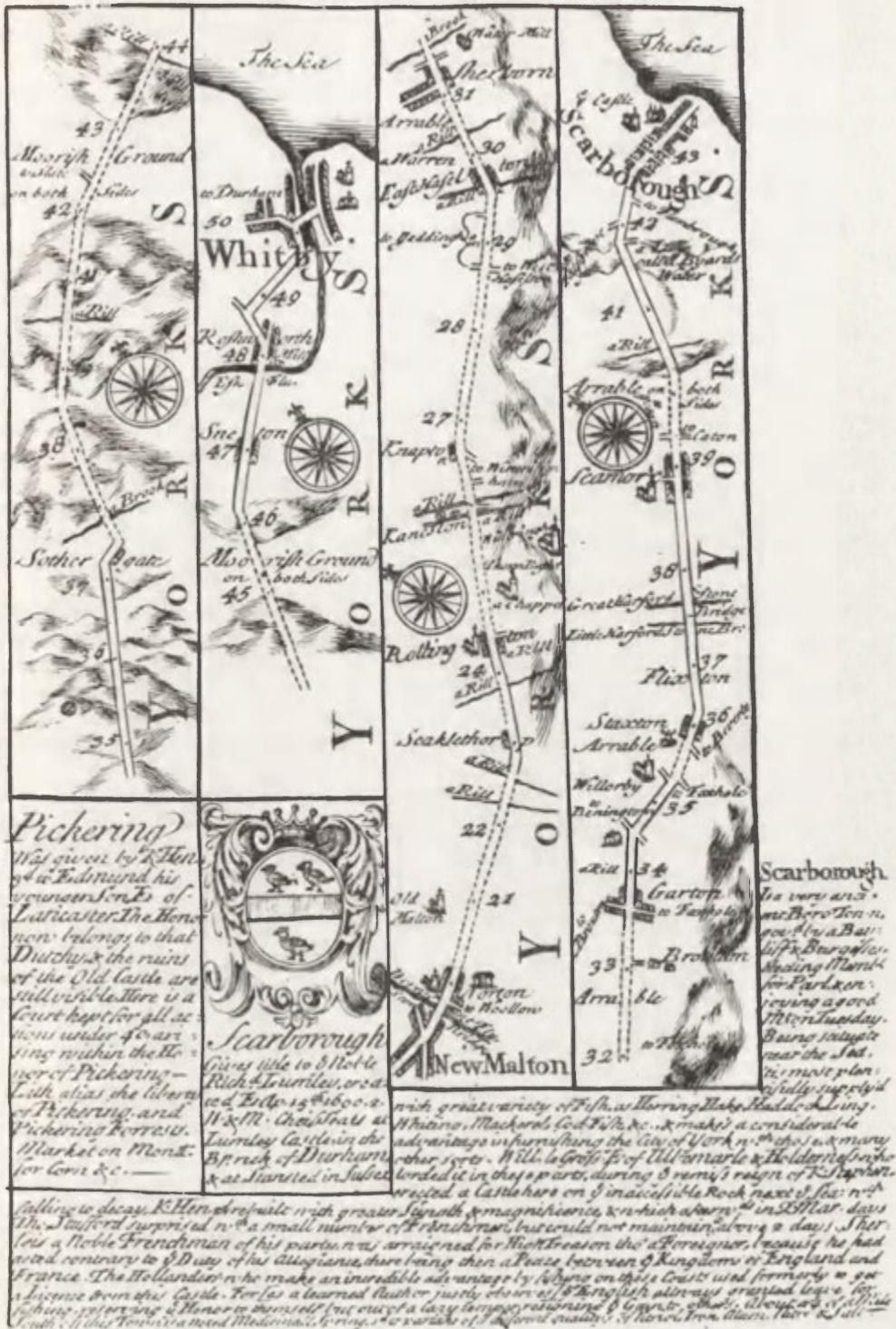


Fig. 5. Page 273 of *Britannia Depicta, or, Ogilby improv'd: being a correct copy of Ogilby's actual survey of all ye direct and principal cross-roads in England and Wales ... with ... a full description ... of all the cities, borough-towns, towns-corporate ... by J. Owen. Engraved in 1720 by Emanuel Bowen, London*

be used by tourists as well as workers on the Rheidol hydro-electric scheme. But there is nothing in the United Kingdom to rival the best-known European scenic route: the Grossglockener road to Franz Josef Höhe in Austria. Similarly, few British road maps show anything resembling the "parcours pittoresques" of French Michelin maps; but there are signposted seasonal orchard tours in Kent similar to, but more abstemious than, the 'routes des vins' in France. The Royal Touring Club of the Netherlands signposts circular tourist routes, but the Automobile Association in Britain only produces leaflets about 'day drives' from selected conurbations and tourist centres. Esso Petroleum have publicized "Tiger Tours" and "off-the-beaten-track" tours for motorists, and much more could be done in a similar way to encourage motoring parties to visit different localities if they so wished.

Who would pay for the roadside improvements necessary for popular scenic routes? A good case could be made for designating a new class of scenic road which would be grant-aided for amenity improvement instead of the usual traffic-speed and -safety improvement. Might conurbation authorities, from whose areas the leisure motorist's party is driven to the countryside, assist the financing of countryside facilities for the leisured pleasure-seekers? Rural local authorities lack the resources to build and maintain adequate roads, footpaths, toilets, litter bins, and car parks.

"Tourism", writes J. B. Jackson,<sup>52</sup> and let us include leisure motoring, "is essentially a geographical experience, a free and leisurely method of learning about the world and about ourselves and our own way of life." And the geographer has much to contribute by writing about this leisurely method of learning. In Great Britain, at least, geographers have often been loath to analyse their immediate environment around schools, colleges, and universities, for non-specialist audiences. Those people able to attend the peripatetic British Association for the Advancement of Science conferences will know that local field enquiry still generates enthusiasm, but the general public is rarely able to share this stimulus. John Ogilby (1600–1676), "His Majesty's Cosmographer and Geographic Printer", offers latter-day geographers a model in his exquisite strip road-maps (Fig. 5). Besides showing the main road system of the day, Ogilby added detail at the side of his strip maps about objects, places and personalities of interest. Could geographers now produce motorists' maps which would bring the *genius loci* and notes about the evolution of regional landscapes to a wider audience? Indeed, map captions and roadside information could be related one to the other.

#### CONCLUSION

So the leisure motorist has made his transhumance for pleasure on the chosen route from city home to countryside picnic spot, and thence has jerked homewards on roads even more crowded than when he set out. Policies for restraining his movements have been listed-but, in the words of Paul Jennings,<sup>53</sup> 'Am I my brother's national park-keeper? Who shall I let in?' Few politicians have yet dared to restrict the mobility of even the weekday motorist, although the countryside preservation lobby meanwhile cries for impeded access by the infernal combustion engine. Like John Bunyan, many country-dwellers desire to 'live in such places where there is no rattling with coaches,

<sup>52</sup> J. B. Jackson, We are taken for a ride, *Landscape*, 11(1962), 20–22.

<sup>53</sup> P. Jennings, I wandered lonely as a crowd, *Yorkshire Television*, 22.30–23.10 hrs., 10 Feb. 1970.

nor rumbling with wheels'.<sup>54</sup> Finally, the opportunity for selecting a new class of scenic road has been outlined. It is hoped that geographers will use their skills to introduce the families in 51 per cent of the 17m households of Great Britain with use of a car in 1969 — and perhaps especially to those without — to the splendours and fragility of the British landscape.

Queen Mary College, University of London

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<sup>54</sup> J. Bunyan, *The Pilgrim's Progress* (1678), quoted in *The Ramblers' Association, Motor vehicles in National Parks* (London, The Ramblers' Association, 1963).

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the statistical tools employed.

3. The third part of the document presents the results of the study, showing the trends and patterns observed in the data. It includes several tables and graphs to illustrate the findings.

4. The fourth part of the document discusses the implications of the findings and provides recommendations for future research. It highlights the areas that need further investigation and the potential applications of the study.

5. The fifth part of the document concludes the study, summarizing the key points and the overall contribution of the research. It expresses the hope that the findings will be useful to the relevant community.

6. The sixth part of the document provides a list of references, citing the works of other researchers in the field. It also includes a list of figures and tables used in the study.

7. The seventh part of the document contains the author's contact information and a statement of acknowledgment. It expresses gratitude to the funding agencies and the participants who made the study possible.

8. The eighth part of the document is a declaration of the author's originality and a statement of the work's contribution to the field. It also includes a list of keywords for the study.

9. The ninth part of the document is a list of the author's previous works and a statement of their availability. It also includes a list of the author's affiliations and a statement of their current address.

PRZYJEMNOŚĆ I

## THE MANAGEMENT OF HEATHLANDS FOR AMENITY PURPOSES IN SOUTH-EAST ENGLAND

EDWARD M. YATES

### INTRODUCTION

The heathlands of south-east England may be grouped into those associated with certain high-level areas of Chalk outcrop, and those associated with sandy soils. The first group, found on soils that, though developed on the Chalk, have been largely decalcified, is now limited in extent since the plough-up campaign of the Second World War. An example of this so-called chalk heath at Lullington, Sussex, is now a nature reserve: the example described by A. G. Tansley<sup>1</sup> is now wooded and part of the Queen Elizabeth Forest, Hampshire. The second group is much more considerable in extent, occupying soils formed on a great variety of sandy formations, such as the Aptian Hythe Beds and Folkestone Beds, the Ypresian Bagshot Beds, and Pleistocene sands and gravels. Such heaths were used by agricultural communities for rough grazing and as a source of fuel for hundreds of years: their plant cover shows the impact of these long-continued practices. These forms of usage as part of an agricultural system are now considerably reduced or have totally disappeared, and the thousands of hectares of surviving heathland in south-east England are of greatest value as an amenity, forming the majority of those parts of the countryside to which the public have complete access. The cessation of management for agricultural purposes and the increased use for amenity have combined to initiate considerable changes in the vegetation and to raise new problems of management. The changes may have been a little accelerated by the destruction of the rabbit population by myxomatosis, but were in progress long before. These problems are here exemplified by consideration of three heaths with differing managerial systems: Blackdown, Sussex; Ashdown Forest, Sussex; and Headley Heath, Surrey (Fig. 1).

### THE PLANT COMMUNITIES

The heaths occupy a variety of habitats that may be conveniently classified in terms of ground-water conditions. The range is from dry areas, usually on ridge tops, where, despite high rainfalls of over 900 mm, the sandy soils promote

<sup>1</sup> A. G. Tansley, *The British Isles and their vegetation*, 1939. See pp. 551-552 and references.

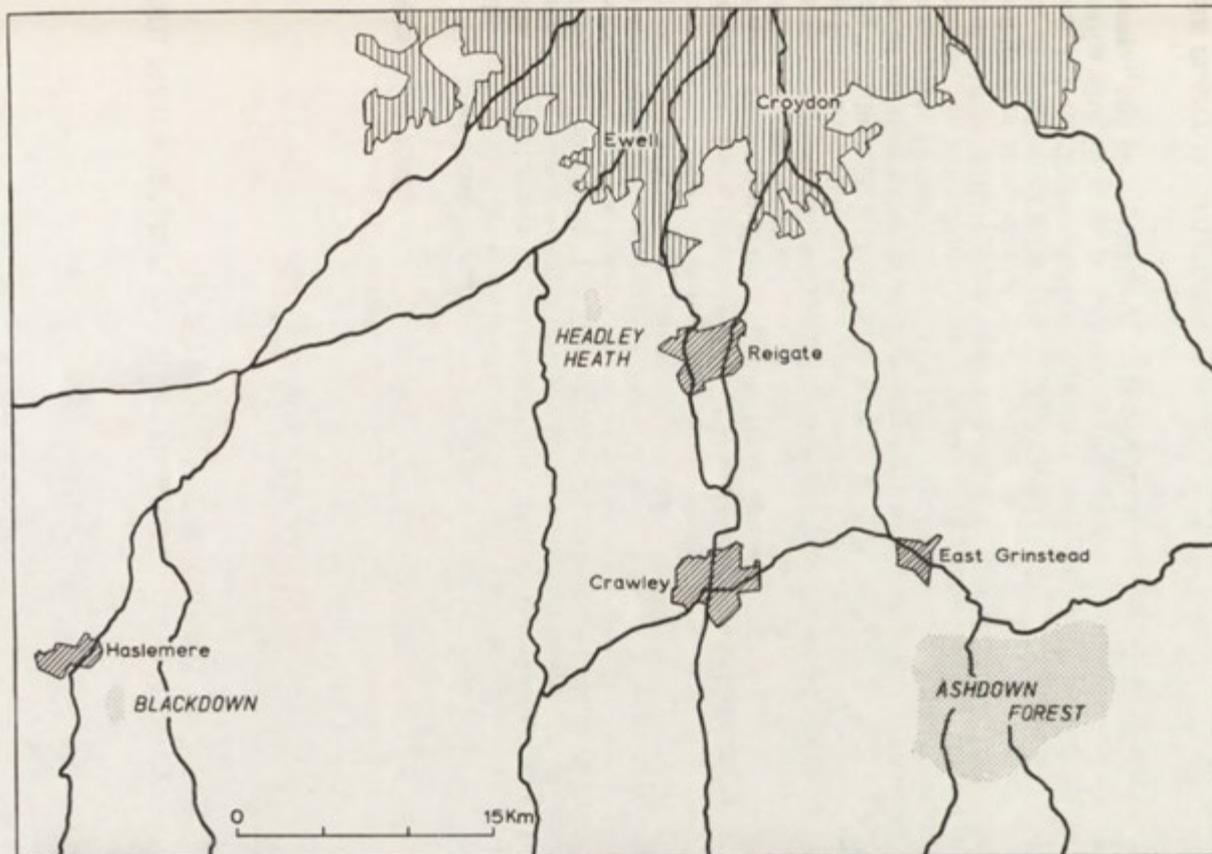


Fig. 1. Location of Headley Heath, Blackdown and Ashdown Forest in relation to "A" roads and the built-up area

excessive drainage, leading to podzolization and to areas with some standing water, brought about by the configuration or by hard pan. Between these extremes are the areas very rarely suffering from standing water but with normally moist soils developed on gentle slopes. The soil moisture condition ranging from dry to waterlogged is part of a continuum, but the plant communities occupying these habitat are sharply distinct. They have been called, somewhat baldly, by English botanists, dry heath, damp or moist heath and wet heath,<sup>2</sup> and the French botanists use a similar simple classification (*la lande sèche, la lande fraîche, la lande humide*). Ellenberg<sup>3</sup> follows Tüxen<sup>4</sup> in distinguishing four categories of heath community in north-west Europe. Two of these are seen as natural, associated either with extremely acid conditions on decalcified sands, bog hummocks, and the margins of raised bog, or with coastal sites much exposed to strong winds. The other two categories are considered anthropogenic *wirtschaftbedingte Heiden*, distinguished from each other by soil water conditions. Leaving on one side the coastal category, the other three categories correspond well with the position in south-east England. The natural heath with extremely acid and wet conditions is characterized by *Erica tetralix* and falls within the Braun-Blanquet alliance *Ericion tetralicis*, notably the association *Ericetum tetralicis*. The dry anthropogenic heath is characterized by *Calluna vulgaris*, and is represented on much of the mainland of north-west Europe by *Calluna-Genistetum typicum*. The moist anthropogenic heath is seen as a transitional form, characterized by *Molinia caerulea*. This corresponds well with the communities distinguished on the heaths under review, and the categories of heath community here employed are therefore:

(A) wet heath, corresponding with *Ericetum tetralicis*,

(B) dry heath, corresponding with *Calluno-Genistetum*,

(C) moist or damp heath, corresponding with Tüxen's transitional form.

The correspondence is not exact since Tüxen's communities were those of north-west Germany.<sup>5</sup> The English dry heaths, for example, contain *Erica cinerea* as an important constituent, a Mediterranean Atlantic element infrequent even in Germany. In south and west central France, as in the *département* of Vienne, anthropogenic heaths created from oak forest have *Erica scoparia* as dominant, with *Erica tetralix* and *Calluna vulgaris* constant. On the drier soils *Erica cinerea* is present and *Erica tetralix* reduced in frequency.<sup>6</sup> Furthermore the adventive or accidental species present are different. In northern Germany it is *Juniperus communis*, in columnar habit, that completes the heathland scene: in south-east England the juniper is rare. Instead of this on

<sup>2</sup> D. T. Streeter, Heathland conservation on Ashdown Forest, *S.P.N.R. Handbook*, 1964, pp. 27-43.

<sup>3</sup> H. Ellenberg, *Vegetation Mitteleuropas mit den Alpen*, 1963, pp. 641-663.

<sup>4</sup> R. Tüxen, Die Pflanzengesellschaften Nordwestdeutschlands, *Mitt. forst-soziol. Arb. gem. Niedersachsen*, 3, 1937.

<sup>5</sup> The classification of English heath communities in relation to the Braun-Blanquet system has not been established, but the dry heaths are certainly part of the order *Calluno-Ulicetalia* and the wet heaths the alliance *Ericion tetralicis*. Both are oceanic groupings, but *Calluno-Ulicetalia* is represented in Poland and *Erica tetralix* occurs in the coastal belt of Poland and at a number of isolated inland stations (W. Szafer, *The vegetation of Poland*, 1966. See Chapter IV on floristic statistics and the elements of the Polish flora by Stanisława Pawłowska, N. B., Fig. 79).

<sup>6</sup> Cl. Ch. Mathon, Notes phytoécologiques sur les brandes d'Usson-du-Poitou. *Bulletin mensuel de la Société Linnéenne de Lyon*, 27(1958), 2, pp. 45-52.

the English heaths it is the Mediterranean element *Rhododendron ponticum* that provides a contrast in colour and it has become increasingly common. The composition of the dry heath association is also changing, with a very marked increase in the occurrence of *Ulex europaeus*.

In addition to the three associations distinguished above two others are present on the heaths under review. They are:

(D) A *Pteridium aquilinum* community

(E) A birch-pine-oak scrub community

The *Pteridium aquilinum* association is remarkably poor, with few other vascular plants apart from the bracken fern itself. The scrub community is made up of young trees and bushes with a closed canopy generally 6 m in height. It is undoubtedly a seral stage, but whether a mixed oak-pine forest of the order *Quercion-pubescenti-petraeae* or more specifically the western European association lacking the pine, i.e., *Quercus-Betuletum*, is not clear.

Changes within these communities and the pattern they together constitute on the south-east English heaths will be considered by dealing with each of the three selected examples in turn.

#### CHANGES IN THE PATTERN OF VEGETATION COMMUNITIES AND IN THEIR CONSTITUTION

##### (a) BLACKDOWN

The Hythe Beds escarpment of the Weald is divided in the north into a number of almost separate hills, of which Blackdown is one of the most westerly. The hill receives a rainfall of about 1000 mm, and the sandy soils are strongly podzolized. For a long period of time until the beginning of this century Blackdown formed part of the common grazing of the Manor of River. It is now a property of the National Trust and used solely for amenity. It is, however, difficult of access by winding steep roads, and with few car parking facilities, so that, even in the height of summer, visitors are few. It is also used to a limited extent as a ride.

The name Blackdown, which presumably refers to the appearance of dry heath communities in the winter months, was first recorded in 1481. Fernden, probably meaning "bracken hill" and forming part of the north west slopes, was first mentioned in 1963. Both communities, that is the dry heath community (A) and the *Pteridium aquilinum* community (D), are important today, but their relative importance is showing significant change.

The vegetation of Blackdown was mapped in 1948-49 and found to consist of a large central area of dry heath with a rim of *Pteridium aquilinum* association (Fig. 2).

A limited area of grassland was present near Cotchet Farm, where the bracken was cut, and a small amount of grazing by tethered animals took place. The *Pteridium aquilinum* association was more developed on the lee slopes and correspondingly more restricted on the west facing slopes. Scrub communities (E) were also mainly eastern in distribution but in one area in the south extended across the hill from east to west. Particularly notable was the *Rhododendron ponticum* community established in the north west, near the Water Works, and the local high incidence of *Ulex europaeus* in the north-east. The wet heath (A) and moist heath (C) association were areally extremely insignificant, restricted to the vicinity of small ponds.

Blackdown was re-mapped in 1956-57. The dry heath (B) was now subdivided into separate areas and *Pteridium aquilinum* had risen to dominance over the

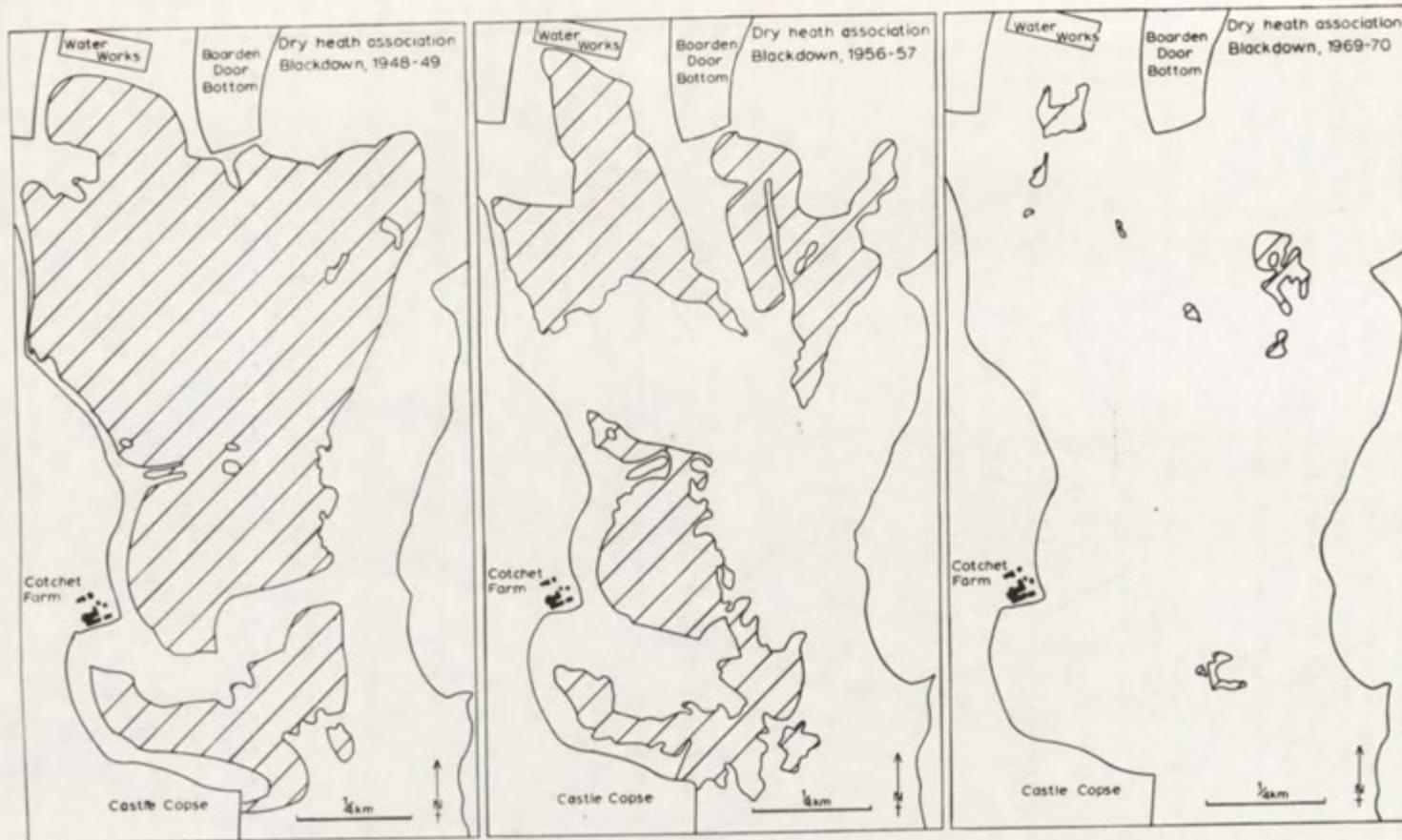


Fig. 2. The dry heath association on Blackdown, 1948-49, 1956-57, 1970-71

central areas. The subdivision of the dry heath on the western slopes of the hill had been brought about in part by a fire in 1954. The continued spread of *Rhododendron ponticum* was also noted. Further mapping was undertaken in 1970, establishing the continued reduction of the dry heath areas by the *Pteridium aquilinum* association and by scrub. The maintained spread of

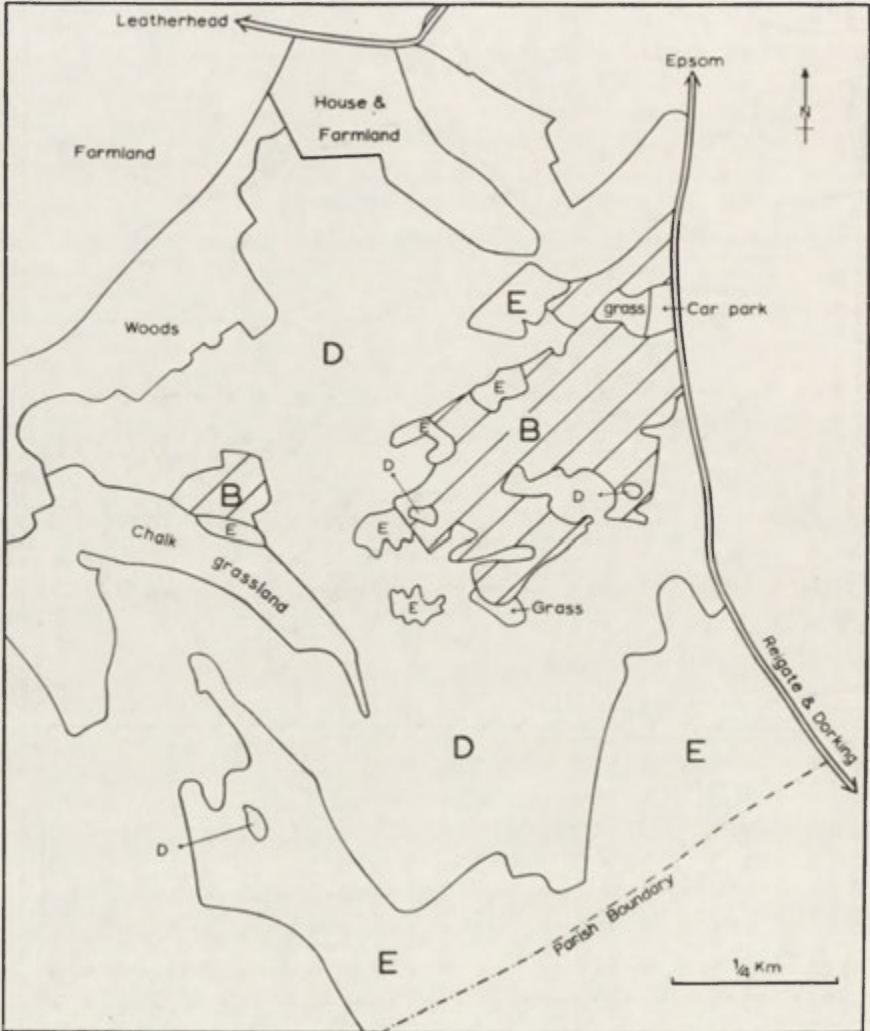


Fig. 3. Vegetation of Headley Heath, 1962-63. Plant associations as in text, i.e. B-dry heath, D-*Pteridium aquilinum*, E-birch-pine-oak

*Rhododendron ponticum* and the increasing importance of *Ulex europaeus* were also evident. The dry heath community (B) was undergoing considerable change, being reduced to small discrete areas, each less than one hectare, although even within these areas numerous well-established seedling pines were

present. Small communities of *Erica cinerea* and *Calluna vulgaris* survived within the scrub and within the *Pteridium* association, particularly in the region burnt over in 1954.

#### (b) HEADLEY HEATH

Headley Heath is situated east of Dorking on the dip slopes of the North Downs where these slopes were trimmed in lower Pleistocene times by a marine incursion. The slopes is developed on sands, resulting from the incursion, which completely mask the Chalk. Like Blackdown, Headley Heath was used as common grazing, shared by the three settlements of East Betchworth, Brockham and Headley, and carried a large flock of sheep.<sup>7</sup> It is now National Trust property, managed by the Headley Management Committee. Unlike Blackdown, access to Headley Heath is easy. It is near to the outer London suburbs, and close to the beauty spot of Box Hill, visited by Londoners for one hundred and fifty years or more.

Headley Heath was mapped for vegetation communities in 1962 (Fig. 3). The *Pteridium equilinum* association (D) occupied much of the central part of the heath and also northern areas where the ground fell towards east-west Headley valley, which bounds the heath on its north side. Dry heath (B) was present on the east of the heath, whereas on the west, where the sands thinned out, a Chalk heath association occupied a valley tributary to the east-west valley mentioned above. Oak-birch-pine scrub (E) formed the southern part of the heath and isolated birch groves were dispersed throughout the heath. Headley Heath was used for tank training during the Second World War, producing some areas of completely denuded ground, and there is some correspondence between these areas of former bare ground and the birch groves. A small grass community had become established near the car park.

Compared with Blackdown, distinctive features of Headley Heath were the high frequency of *Ulex europaeus* and birch throughout the bracken and the dry heath association, the virtual absence of rhododendron and the lesser frequency of pine.

Remapping in 1970 showed that the minor western area of dry heath (B) was much diminished and had become open, with wide patches of totally bare soil. The major eastern area was also much reduced, surviving in the main as an outer ring to the grass near the car park. Its former extent was replaced by bracken and on the south by a closed *Ulex europaeus* community, completely impenetrable and apparently stable in that no seedling trees were appearing through it. Also notable were the considerable patches of bare ground beside the path, due to trampling, in part by horses since the heath is much used as a ride.

#### (c) ASHDOWN FOREST

The common lands of Ashdown Forest are a remnant of a once far greater region of open land used for grazing, hunting and fuel provision. There are numerous records with references to poaching game and unlawfully cutting timber. In an inquiry of 1611<sup>8</sup> the free tenants of Duddleswell and Maresfield had rights to "estover", fuel, and common of grazing, and customary tenants

<sup>7</sup> Surrey Record Office document Acc. 108, manorial court rolls of Headley. There are references to sheep flocks in the early 17th century and to the unauthorised cutting of bracken.

<sup>8</sup> Public Record Office (London), document DL/44/860.



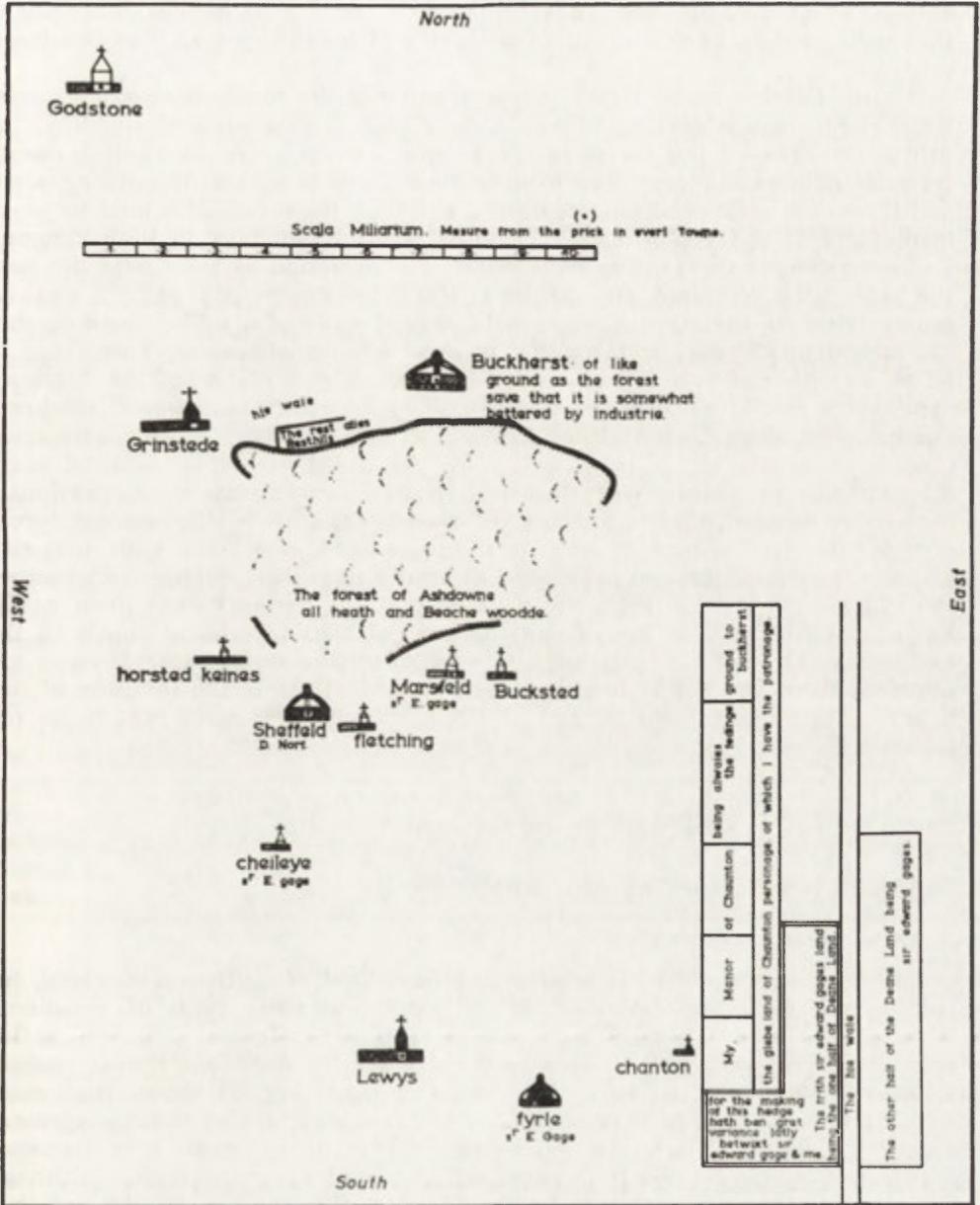


Fig. 5. Ashdown Forest, early 17th century, with references to up-grading of soils in the north-east, and to beech woodland

conservators number 19, nine being commoner and ten appointed by the relevant local authorities: the chairman is elected, but by custom is a commoner. The irregular shape of the surviving common is the result of the enclosure of 1693 and of the long period of gradual enclosure previous to that date. Some of the improved lands around Ashdown Forest have soils similar to that under heath, as was noted in the early 17th century map<sup>11</sup> of the forest (Fig. 5).

Unlike Blackdown or Headley Heath, some of the commoners still exercise their rights to the grazing of cattle, but, like Blackdown and Headley, the principal usage of the forest is for amenity. Main roads to coastal resorts traverse Ashdown Forest. The Conservators have provided 87 parking areas and there are various picknicking sites, although these facilities tend to prove inadequate at the Whitsun Bank Holiday and on Sundays in high summer.

The Ashdown Sands, the main geological formation of the forest, lie near the base of the Wealdian, and consist of 100 to 200 metres of iron-rich, weakly-consolidated sandstone, with occasional bands of clay and silt. The forest reaches 220 metres in altitude, with a relief of over a hundred metres. This range of relief, a rainfall of over 900 mm and the variation in the facies of the Ashdown Sands, give rise to a greater range of habitats than are present on Blackdown. Furthermore, the soils tend to be heavier, so that there are considerable areas of valley bog with wet heath communities (A), and the transitional moist heath (C), in addition to ridge-top dry heath (B). Both the other associations previously named are present, that is bracken, *Pteridium aquilinum* (D), and oak-birch-pine scrub (E). Distinctive are flush communities associated with iron-rich water. Some rhododendron is present, generally near the peripheral enclosures, as at Legsheath Gate in the north-west (Fig. 4), the parent plants, presumably, having been planted in the gardens of some of the large houses built on the enclosures. As on Headley Heath and on Blackdown considerable changes are attested. These are the widespread development of scrub, the invasion of dry heath by bracken and the spread of *Molinia caerulea* into the wet heath (cf. footnote 2).

## DISCUSSION OF CHANGES AND MANAGEMENT

### (a) FORMER MANAGEMENT

There is little doubt that most of the heathland of south-east England, including the examples described, would revert to some form of woodland, whether *Quercion-pubescenti-petraeae* or *Quercus-Betuletum*, if human influence were removed. The various enclosures within Ashdown Forest contain woodland today and an early 17th century map (Fig. 5) shows that some woodland survived until that period, as is also made clear by the management practices described. There can be no doubt that all three heaths here discussed are anthropogenic, created from woodland as part of a farming system, although it is possible that there were more open areas within the woodland<sup>12</sup> and that the more acid wet heath is natural in origin. On Blackdown, unaffected by

<sup>11</sup> Public Record Office document S/P 995, MPF 144.

<sup>12</sup> So argued by Dr. F. Rose (personal communication), because of the presence of liverwort species *Nardia compressa*, associated with streams in open habitats.

grazing and with little amenity impact, the process of reversion is well advanced. Management in the past aimed at the preservation of heath communities by grazing and, in some instances, by the use of controlled burning. The heath ecosystem leads to an accumulation of organic debris more rapidly than the decomposition of such material. It is not in equilibrium, and must lead ultimately to degeneration. Fire, by releasing the stored nutrients, leads to strong fresh growth, and, of course, prevents scrub invasion.<sup>13</sup> Grazing would have the same effect, but more selectively. The burning must be controlled and regular, for otherwise the accumulation of peat leads to high temperatures being recorded and consequent destruction of the *Callunetum*, with a subsequent invasion by *Pteridium aquilinum*. The complicated relationships of *Pteridium aquilinum* and *Calluna vulgaris* have been worked out by A. S. Watt.<sup>14</sup> The bracken penetrates the *Callunetum* when the latter is degenerate, that is old, as would occur were the *Callunetum* not fired regularly. Irregular burning, however, facilitates bracken invasion, as appears from the Blackdown evidence. Controlled burning is still practised in Ashdown, but all three of the example areas suffer from accidental burning, leading to the spread of bracken. Also of importance is the cessation of bracken cutting. In medieval and early modern times the bracken was cut for bedding cattle: indeed the right to cut was "stinted". References to cutting bracken unlawfully are made in the manorial court rolls for Blackdown and for Headley. The usage of bracken for cattle bedding is still a practice in parts of France. Similarly, the spread of *Ulex europaeus* is partly due to the fact that this plant was formerly cut for fuel and fodder.

Different practices were obviously necessary where large areas of woodland survived mixed with the heath communities. The references to beech-mast and pigs give further proof that woodland had survived on Ashdown into early modern times. By prohibiting grazing at certain periods management does appear to have aimed at the survival and regeneration of the woods. Indeed, as noted, there is specific reference to preservation of "bushes and maste".

The moist heaths are considered to offer the most advantageous conditions for tree growth, since it is the most nutrient-rich habitat and it is here that the most rapid development of scrub is to be expected.<sup>15</sup> But the scrub is also spreading into the wet heath despite the arguments for its natural status. The habitat conditions are changing and Streeter (cf. footnote 2) suggests that accidental fire is one of the causes of the spread of *Molinia caerulea* into the wet heath, but fire would, of course, inhibit the invasion by scrub.

#### (b) PRESENT DAY MANAGEMENT AND THE EFFECT OF AMENITY USAGE

Blackdown and Headley Heath are both National Trust properties with management committees consisting of local government representatives and members of the National Trust. For Blackdown two rangers are employed,

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<sup>13</sup> S. B. Chapman, Nutrient budgets for dry heath ecosystems in the south of England, *J. Ecol.*, 55(1967), pp. 677-689.

<sup>14</sup> A. S. Watt, Bracken versus heather, a study in plant sociology, *J. Ecol.*, 43(1955), pp. 490-506.

<sup>15</sup> K. Loach, Relations between soil nutrients and vegetation on wet heaths, *J. Ecol.*, 54(1966), pp. 597-608, and 56(1968), pp. 117-127.

and there is a voluntary woodland-manager. The wages for the rangers come from central funds of the National Trust, local subscriptions, and from the sale of wood products, such as besoms. Management consists of clearance of scrub from viewpoints, provision of a nature-trail, and some planting, thinning, etc., of the coniferous woods developing from the scrub. Headley Heath has no permanent staff but some voluntary management work is undertaken such as the clearance of an area of scrub in 1963 by the Conservation Corps of the Council for Nature. Horse trampling is particularly intense on Headley Heath and another management practice has been the attempt to separate bridle paths from foot paths. Ashdown Conservators employ three rangers and a forest superintendent, with an additional patrolman for weekends for half the year. The wages of this small staff come from monies supplied by the local authorities and by a small rate on the commoners, but the budget is small for so large an area. Much of the time of the staff is taken up by litter collection, but a more positive side of management is the maintenance of fire breaks, and the controlled burning to which reference has been made. Both management committees and the Conservators have provided car parking and have sought to prevent cars gaining access to the heaths in other areas by banks, ditches, notices, posts in paths, etc., with a good degree of success.

The effects of amenity usage are the accidental fires and the destruction of heath by treading in the immediate vicinity of parking and picknicking places. The growth and spread of *Ulex europaeus* limits access to large parts of all three heaths and has the possibly positive effect of limited disturbance to wild life and the negative effect of concentrating treading. Bracken likewise limits access, and is obviously unattractive for picnic areas and further concentrates this form of usage. Of the three heaths here discussed Headley Heath shows the most marked deterioration, with big patches of bare ground. This is due to its small size relative to Ashdown and to its proximity to London compared to Blackdown.

#### NEED OF MANAGEMENT

The wise management of the heaths obviously depends upon a clear formulation of policy and a sufficient budget to put the policy into effect. Neither requirement is as yet met.

The preservation of the heath ecosystem cannot be argued on the grounds of its "naturalness". The changes described show it to be little more natural than a London park. Preservation can be argued on the grounds of the amenity value of its flora and fauna and its open quality, often associated with wide views. In colour the heaths are undoubtedly beautiful; many of the wet heath plants are of outstanding interest; and as a habitat the heath has its own particular fauna, including, for example, the Dartford warbler *Sylvia undulata*, and the nightjar *Caprimulgus europaeus*. If for such reasons as these it is decided to preserve the heaths then a programme of grazing plus some controlled burning and bracken cutting is necessary. Selective herbicides might be argued as a control of the bracken but would probably lead to difficult and unwelcome side effects. Managed grazing would entail sheep flocks plus shepherds, but the introduction of or an increase in, the number of deer would add to the amenity interests. Any attempt to introduce sheep would probably meet with serious difficulties because of the dogs which are exercised on the heaths. The establish-

ment and control of deer populations may present a method of utilizing the heaths as an additional source of protein.<sup>16</sup>

On the other hand the heath ecosystem is not highly productive. The plantation of moorland on the island of Rhum, Scotland, by the Nature Conservancy has led to a very considerable increase in bird population.<sup>17</sup> Similarly at Newborough Warren, Anglesey, the planting of the dune complex led to changes in type and density of the avifauna, the density increasing as much as ten times.<sup>18</sup> The plantation on Rhum is with many species of tree, e.g. Scots pine, oak, hazel, holly, etc., and there is little doubt that woodlands with undergrowth provide a bigger population. In the Scottish Highlands the population in natural pine forest with undergrowth was found to be seventeen times that in intensive pine plantation.<sup>19</sup>

Afforestation is therefore likely to increase the amenity value of the heaths in the sense of providing a more interesting or diversified fauna, not as an alternative to preservation but as a supplement. Wide belts of mixed woodland would provide a far greater range in habitat and at the same time lesser fire risks. Given that such planting was judicious there need be no loss of landscape view but rather visual improvement. Selected blocks of heath vegetation could then be effectively preserved rather than spreading the effort over the present very large areas ineffectively managed. The planted woodland would, of course, require management but, being nearer to climax vegetation, less than that required to maintain the heaths. The suggested policy for the southern heaths is, therefore, preservation plus mixed plantation. Apart from the financial problems of acting on such a policy, legal difficulties would arise in some instances, as for example Ashdown, because of commencing rights. The present budgets employed on the three heaths described are obviously completely inadequate to preserve them as heathland. Further monies or well-organised regular voluntary assistance must be forthcoming. Otherwise the heaths as such will disappear. They would, of course, survive as open spaces but be under-employed in that the growth of gorse and scrub will restrict utilization by the public.

There is in this a role for the geographer. Public utilization of the heaths is inevitable, and is desired. Conservation, if to be successful, must involve the public. The interest of the public is shown by the success of nature-trails. The geographer can participate by writing regional studies of the individual heaths, free from jargon but not patronising, and at the same time suggesting points of interest. With clear maps of footpaths, parking and picnic sites, this will spread public usage more widely and therefore reduce the impact. On Ashdown Forest, for example, the history of enclosure has left the surviving open heath with an extremely irregular outline, so that a guide to access would be of value.

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<sup>16</sup> For a discussion of the possibilities of utilizing deer in this manner, their habitats and food, see publications of the British Deer Society, e.g. *Muntjac*, Oliver Dansie, 1970.

<sup>17</sup> L. A. Batten, Effects of reafforestation on the birds of Rhum, Scotland, *Bird Study*, 16(1969), 1, pp. 13-16.

<sup>18</sup> P. Hope-Jones, The bird population succession at Newborough Warren, *Brit. Birds*, 59(1966), 5, pp. 180-189.

<sup>19</sup> A. Watson, Preliminary counts of birds in central Highland pinewoods, *Bird Study*, 16(1969), 3, pp. 158-163.

At the same time the long history of enclosure has left many relics in the landscape, revealing previous patterns of access gates, marl workings, etc. Tudor iron working and the vernacular architecture of the peripheral farms (dating back to the fourteenth century) are further matters in which a lively interest of the public could be stimulated. Idiographic regional studies and historical geography are little regarded today by many professional geographers, whilst applied geography, in keeping with the contemporary ethos, is highly valued. It is paradoxical that it is in this extremely important field of applied geography that idiographic historical regional studies are greatly needed.

King's College, University of London

## VILLAGE RELICT FEATURES WITHIN THE SPATIAL LAYOUT OF SOME POLISH TOWNS

HALINA SZULC

In this paper attention is drawn to various relict features of villages surviving within urban spatial layouts. The development of research methods within the last few years in Poland and elsewhere regarding the analytical study of villages, especially the method of metrological analysis of sites and fields, can also be extended to studies of towns. The relict villages, although absorbed by the town and considerably urbanized, can still be recognised in the present-day street pattern, and may, indeed, play a part in influencing the evolution of the modern town.

(1) The largest group of Polish towns consists of those founded in the Middle Ages. The town walls, surrounding a regularly-shaped market-place, with streets and blocks of houses near the market-place, constitute the *internal* boundary of the historical suburban zone. However, the determination of the *external* boundary of the suburban zone is not easy. This boundary is to a certain degree defined by the spatial extent of urban privileges and by the distribution of satellite settlements. It can be suggested that in the geographical-historical analysis of the suburban zone the most interesting problem is that of the suburban settlements themselves. The mediaeval town, in addition to the area within the walls consisted also of a number of suburban settlements, closely related in terms of genesis and functions to the main nucleus. The examples discussed here mainly concern Silesian towns which the author has studied for many years.

Plans of towns (with adjacent villages) and village plans are the basic material for this research work. In Poland the majority of the older town and village plans drawn on large scales date from the beginning of the 19th century. As far as villages are concerned, these are the so-called "separation plans", made in connection with the regulation of fields (*Bodenregulierungen*) at the beginning of the 19th century. In addition to the plans of towns and villages there are also "ground books" (*Grundbücher*), "urbaria", and measurement registers.

The "model" method has been adopted in this work on the analysis of historical village plans, based mainly on the metrological method of Professor David Hannerberg of Stockholm in his studies of early mediaeval sites and fields.

Work on the models of villages existing in Silesia has been the basis for drawing conclusions concerning the characteristic types of suburban villages. Thus, for instance, the following types of villages in Silesia have been accepted

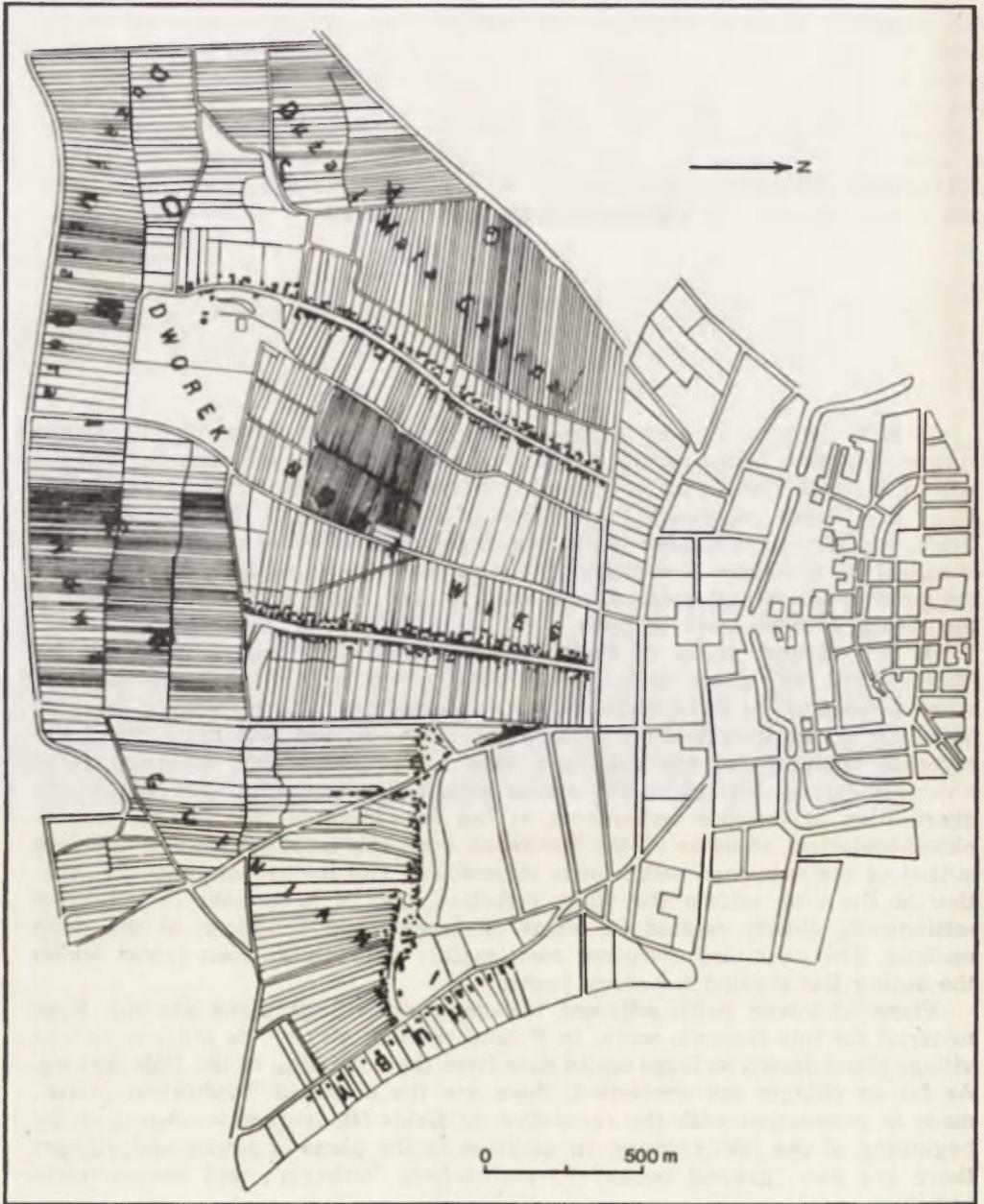


Fig. 1. Vegetable-growing villages in the vicinity of Wrocław at the beginning of the 19th century. Street villages stretching along the roads leading to the town, with narrow strips situated behind the farmsteads.

as models: the open-field village and the forest and field village, with their characteristic ground plans and proportions of the sides of the sites, situation of the site in relation to the village boundary and to the fields, length and width of fields, and other features. On the basis of these studies it was found that the suburban villages differed from the well-known schemes of villages situated further away from the town (Fig. 1).

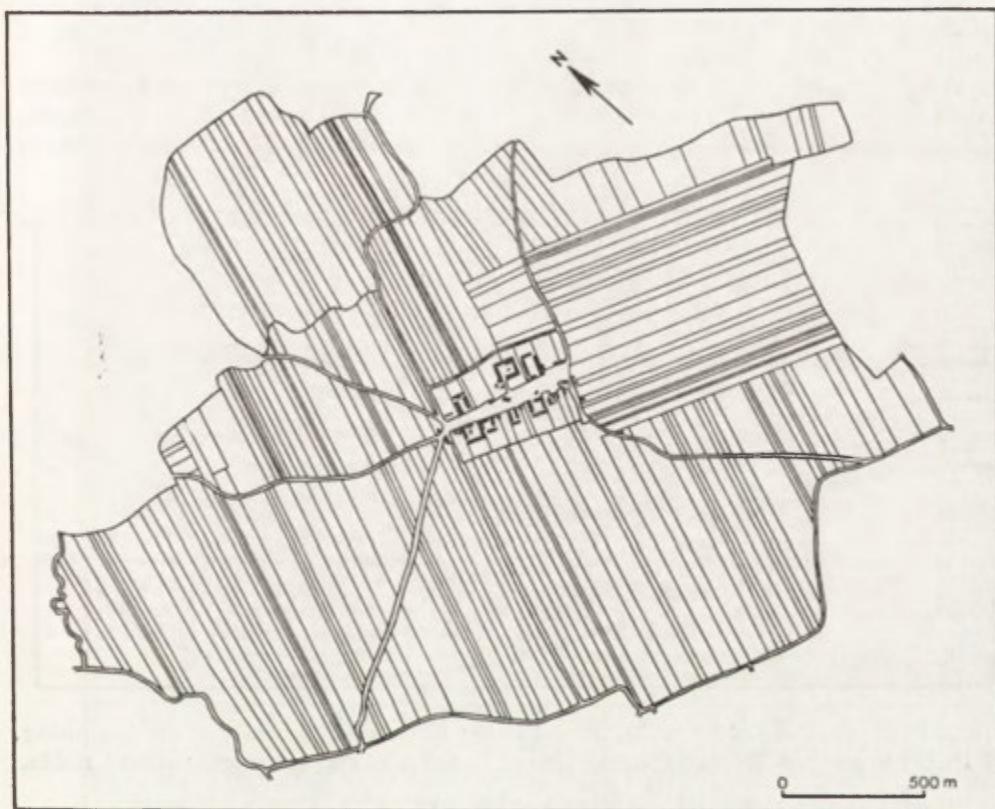


Fig. 2. Peasant village of Oporów in the vicinity of Wrocław at the beginning of the 19th century. Typical green village with the three-field system.

From the example of Wrocław it appears that the cottagers' and vegetable-growing villages are the most characteristic for suburban areas (Fig. 2). These villages were founded as free cottagers' villages in the 13th century, i.e. they were contemporary with the foundation of Wrocław itself. The situation of these villages in relation to the town is very characteristic. They stretch along the roads leading to the town. In their layout they are similar to street villages, with a tightly-built-up site area and a field pattern in the form of narrow strips immediately behind the farmsteads. These narrow strips, the width of which does not exceed 10 metres, are very characteristic for the intensive cultivation of vegetables, medicinal herbs and dyeing plants. The spatial layout of cottagers' and vegetable — growing villages is essentially different from that of agricultural villages inhabited by peasants and situated

at a greater distance from the town. Moreover the cottagers' and vegetable growers' villages are distinguished by a great density of population, amounting to over 400 inhabitants per sq. km at the end of the 18th century, thus giving a density typical of a town rather than of an agricultural village, the density of which averaged 30 to 50 inhabitants per sq. km at that time.

These villages were inhabited almost exclusively by free cottagers to whom the whole cultivated area belonged, in contrast to other villages situated further from the town, where cottagers constituted only a part of the inhabitants, and where cultivated fields belonged to manors or to peasants, while the cottagers had no land except for the gardens round the houses.

Analogous suburban villages of cottagers and vegetable growers have been found in the vicinity of other towns in Poland, such as Legnica, Oleśnica, Brzeg, Nysa, Ząbkowice or Głogów. The cottagers' and vegetable growers' villages

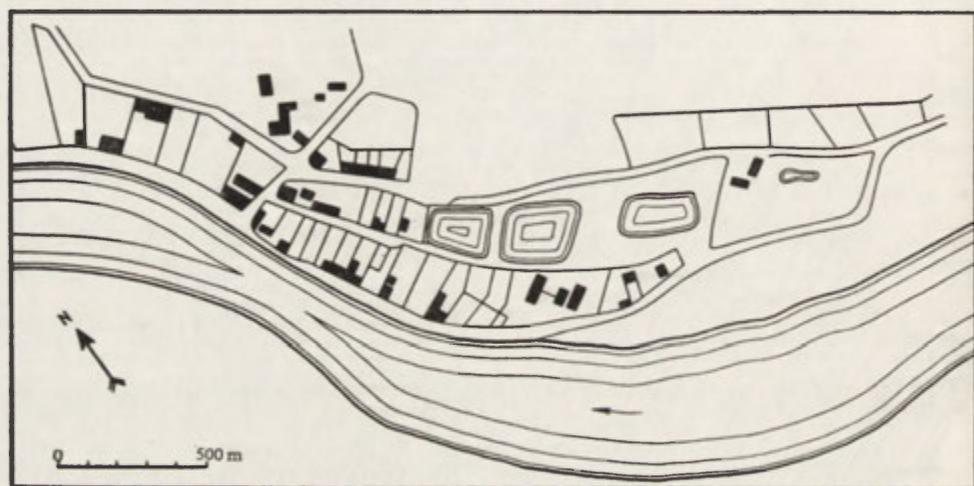


Fig. 3. Fishing village of Nowe Szczytniki in the vicinity of Wrocław at the beginning of the 19th century. Compact street village situated along the river, without fields.

appear also in the vicinity of Kraków, Poznań, Warszawa, as well as near Vienna, Nürnberg and other mediaeval towns. A great number of vegetable growers concentrated near large towns, which constituted very active markets for vegetable, medicinal herbs and industrial plants. Vegetables, as easily perishable products and therefore unfit for longdistance transport, had to be grown in the immediate neighbourhood of the town.

In the suburban zone there were also other types of suburban villages at the beginning of the 19th century. Very characteristic among these were the fishermen's and craftsmen's villages. Fishermen's villages had no fields and the village site was mostly composed of one row of houses situated along the river. Less frequent are fishermen's villages situated at a right angle to the river or within its meanders. Research work on these villages, however, is difficult within the area of large towns, because they have been absorbed by the town and transformed. In Wrocław they appeared along the river Odra and its tributaries, at Szczytniki, Rakowiec and Nowe Szczytniki, Czepiny and Rybaki (Fig. 3).

Interesting examples of fishermen's villages have also been encountered

in Opole and Brzeg. In Warsaw the ancient fishermen's settlement, formerly called Rybitwy, is situated to the north of the Old Town. The present Rybaki street corresponds to the road of the ancient fishermen's village situated on the banks of the Vistula.

Some villages with specialised functions, such as weaving, pottery, shoemaking and others, have formed certain characteristic types of suburban village (Fig. 4). High densities of population and certain socio-economic patterns were

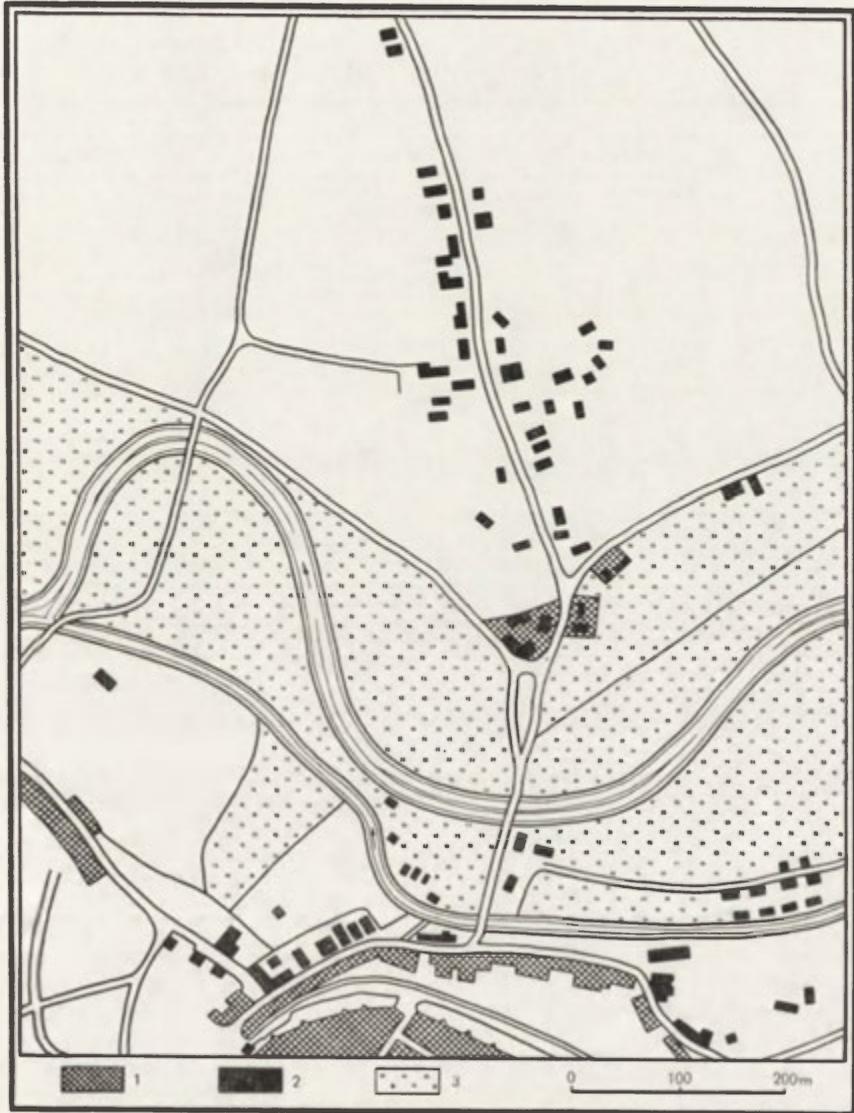


Fig. 4. Weavers' village in the vicinity of Jelenia Góra at the beginning of the 19th century.

A village with chaotic layout and without arable land. 1 — urban built-up area of Jelenia Góra, 2 — rural built-up area, 3 — meadow.

the common features of these villages. These villages were inhabited at the turn of the 18th century not by peasants but by cottagers or farmhands. In view of their non-agricultural functions, these villages had no arable land but only small greens for bleaching linen or for other special purposes. The built-up area in these villages was usually amorphous, indicating their evolutionary origin.

These types of suburban village can be shown to be contemporary with the foundation of the related towns, as in case of Gajowice village in the vicinity



Fig. 5. Reconstruction of the layout of the southern district of Wrocław at the end of the 19th century. Old vegetable-growing villages, squares in geometrical shapes, and new streets along the course of ancient roads.

of Wrocław. Such villages were functionally strictly connected with the town and formed its natural economic hinterland. They differed from each other in their functions. There were, therefore, vegetable growers', weavers', potters', fishermen's and other villages. The longlasting functions of these villages are to be seen in their spatial layout. These villages were not differentiated from their neighbouring town by density of population or by socio-economic structure, and so, in the first stage of extension of the urban boundaries, upon the demolition of the defence works, they were incorporated into the town.

In connection with the rapid growth of the town in the middle of the 19th century, the functions of the former cottagers' villages directly adjacent to the suburbs were taken over by villages situated further from the centre of the town. On the other hand, housing development took place on the area of

former vegetable growers' villages, which then became one of the most densely-inhabited parts of the town, while the vegetable growing itself was pushed away further to the south. The social composition of the inhabitants residing in the area of former vegetable growers' villages in 1864 proves that although former gardeners were still the owners of houses, the villages were inhabited mainly by workers, who, together with journeymen, servants and dependent artisans, constituted about 50% of the population in this area.

In 1868 the vegetable growers' villages in the vicinity of Wrocław were annexed to the town. The urbanization processes were very intensive in this area and have effaced the traces of former suburban villages, which can be found today only in the names of streets and settlements or in a characteristic alignment of the streets, e.g., Gajowicka street (now Adam Próchnik street) and Gliniana street.



Fig. 6. The peasant village of Zaborze in the year 1820; at present one of the town districts of Zabrze.

A typical green village with the three-field system. 1 — site, 2 — meadow

The development of capitalist industry caused an inflow of workers looking for cheap lodging as close as possible to the town. The "gardeners" transformed stables and other farm buildings into small lodgings, thus increasing the number of dwellings. In addition to the overcrowded rural buildings, where all the most primitively equipped structures were utilised as dwellings for poor working people, houses were built in the newly laid out streets for the rich. Dispersed rural buildings were replaced by tightly-built urban blocks, the winding rural roads were straightened, and squares were drawn up to a geometrical design, e.g., Powstańców Śląskich, Hirszfeld and Jakub Szela squares,

which form distinct elements in the patchwork of straight streets, such as Powstańców Śląskich, Sudecka and Krucza (Fig. 5). This quarter of Wrocław was destroyed during the Second World War and a modern housing district arose in its place. It must, however, be added that even today the course of the principal arteries of traffic leading from the centre of the town to the south corresponds to the course of the former rural roads.

(2) A quite different type of relict village appears in the area of the newest towns of the Upper Silesian Industrial Region — Zabrze, Katowice, Sosnowiec — which arose by the growing together and rapid transformation of former agricultural villages into industrial settlements during the Industrial Revolution, and from newly-established miners' and metal-workers' settlements. In most cases there were ancient agricultural villages with open-field pattern and with a three-field economy (Fig. 6).

In connection with the rise of industry in the second half of the 18th century and in the early 19th century, a very rapid process of urbanization took place in these villages. The enlargement of the village was performed in three directions: by infilling, by extending the village through the addition of new farmsteads, and by the division of farmsteads already existing. All these possibilities were realised at Zabrze. The built-up area, the social and occupational composition of the inhabitants, and the density of the population changed radically. Such villages as Biskupice, Ruda and Zaborze at the turn of the 19th century were still villages from the legal point of view, although their population was composed of workers and they numbered some thousands of inhabitants. One can reconstruct in the late 18th century plan of Zabrze the outlines of the mediaeval villages of Stare Zabrze, Biskupice, Zaborze, Makoszowy, Mikulczyce, Rokitnica, as well as those of the 18th century industrial "colonies" of Małe Zabrze, Dorota, Kuźnica, Maciejów, Kończyce and Pawłów (Fig. 7). Old rural settlements differ distinctly from the colonies with regard to the character of building, size and topographic situation. While the old settlements utilised valley sites on the banks of streams or around ponds, the new settlements were related not to the topographic situation but to the system of roads.

These colonies also differ from mediaeval villages in their size and in the geometrical disposition of buildings, which were arranged symmetrically at equal distances one from another. The built-up areas of the settlements newly founded in the 18th century were much smaller than those of the old villages. Kuźnica settlement, founded in 1725 (a section of the present Kondratowicz street), consisted of only an ancient iron foundry and a few houses. Dorota settlement, founded in 1774 in place of the manor existing there (the neighbourhood of the present Opolska and Sienkiewicz streets), included 16 farms, and Małe Zabrze (situated near the present ks. Bończak and Krakus streets), 14 farms.

Zabrze, the newest town of the Upper Silesian Industrial area, which, with 65 thousand inhabitants, was until 1922 the largest European village, has not any uniform urban layout. The building of Zabrze took place spontaneously along main roads, railway lines, and around industrial plants. The trend of construction of Zabrze was influenced by the state road constructed early in the 19th century, which in this section is covered by Wolność Street, and by the old rural roads leading north-east to Bytom, and southwards to Mikołów and na, which now form Bytomska and 3 Maja streets (Fig. 8).

Zabrze has no market place. The 24 Stycznia square is a substitute formed by the demolition of old properties. A further characteristic feature of the spatial layout of this town, which has arisen on the road plans of old mediaeval villages and of the new industrial colonies, is the dense knot formed by the

traffic thoroughfares within the town. The railway not only severs the present centre of Zabrze but, with numerous sidings leading to the respective industrial plants, it forms a dense network of lines along which, as along main roads, workers' settlements have arisen (e.g., Małgorzata street and the buildings along Wolność Street near Zaborze-Poręba settlement).

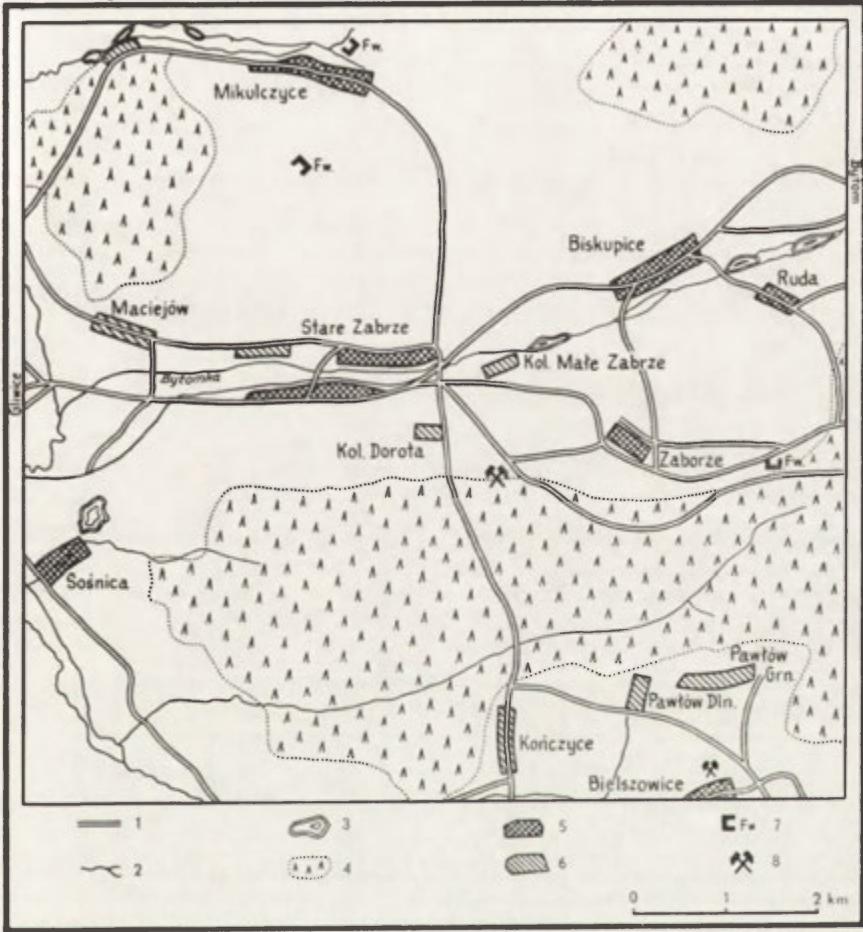


Fig. 7. The area of the present town of Zabrze at the end of the 18th century  
 1 — main roads, 2 — rivers, 3 — pond, 4 — woods, 5 — old village mentioned in the Middle Ages, 6 — settlement founded in the 18th century, 7 — farmstead, 8 — mine

In towns of this type it is usually a question of accident which of the villages will be granted town status. In the case of Zabrze, Stare Zabrze village competed with Zabrze village, which had a much larger number of inhabitants. (Stare Zabrze had 1595 inhabitants and Zaborze 2175 inhabitants in 1870 while in 1895 Stare Zabrze had 4787 inhabitants and Zaborze 15,263.) The fact that Stare Zabrze village and not another industrial village, e.g. Zaborze, became the town was due to its situation at the crossroads. In the case of Zabrze, as in the case of Katowice, transport and not industry was the decisive factor in locating the centre of the settlement.

Katowice, which became a town in 1886, had a similar history of development. Katowice was competing with Bogucice, a village known since the 14th century for its forge and then its blast furnace. Early in the 19th century Katowice was a village with 486 inhabitants, of whom 77 were cottagers and 18 farmhands (data for 1816).

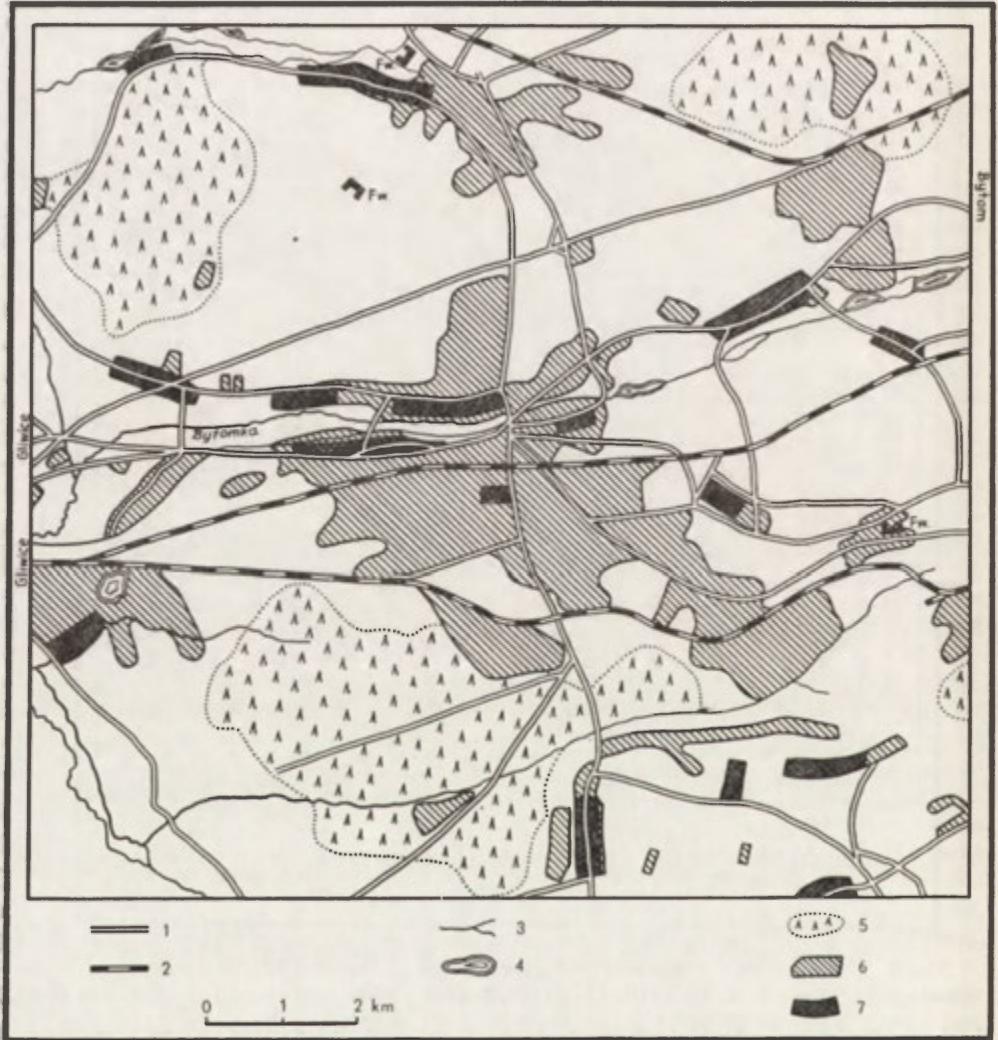


Fig. 8. The area of the present town of Zabrze at the end of the 19th century  
 1—main road, 2—railway track, 3—river, 4—pond, 5—woods, 6—urbanized areas in the  
 19th c., 7—old settlement

Similarly, it was not without importance for the further development of Zabrze that the first Upper Silesian railway line did not pass through Zabrze and that therefore a year later a branch line was built leading to the new industrial enterprises. Thus, as in the case of Katowice, transport played an important role in the development of the town.

The rapid development of Katowice can be traced back to 1863, the year of the building of the railway line from Wrocław to Mysłowice. This also influenced the spatial layout of the town, where the centre is at the crossing of roads and railway. The beginning of Greater Katowice was due to the incorporation of neighbouring villages, such as Dąb, Bogucice, Załęże, Ligota, into the town in 1924, thus increasing its area tenfold.

Sosnowiec, the third example of an industrial town dealt with here, began to develop in the second half of the 19th century, thanks to the incorporation of some settlements and estates which have remained within the present boundaries of Sosnowiec (i.e., Pogoń, Sielce, Małobądz, Miłowice). The building of the railway line to Katowice led to the development of Sosnowiec, a poor settlement composed of an estate and of a few peasant farms. The increase of custom duties on foreign products was a favourable factor in the development of industry in Sosnowiec because it induced German industrialists to cross the border to build factories in the so-called Polish Kingdom and especially in the border region. From 1879 a rapid development of industry began in Sosnowiec and in the adjacent settlements.

Another characteristic feature of industrial towns is the building of groups of dwellings in the direct vicinity of the industrial enterprises. Since no protective zones in the form of green belts between the industrial plants and the dwelling districts were planned, the workers' houses were often built in unhealthy conditions near foundries and burning slag heaps. The initial growth of towns of this type was chaotic and connected with mining exploitation. On the other hand, areas of intensive mining activity had to be free of buildings, thus producing an uneven scatter of settlements, so that close to overpopulated areas there may be areas such as a park in Zabrze quite free of buildings.

While mining hampers the uniform development of a dense network of settlements, metallurgy helps the development of compact settlements because factories and other industrial enterprises occur in the neighbourhood of foundries, thus leading to the development of the most densely-populated quarters of the towns. Towns of this type have no old quarters because even the old villages on which the spatial layout may be based, have been completely transformed.

Relict villages are difficult to find in the plans of those towns in the Upper Silesian Industrial Region which arose in the 19th and 20th centuries. However, a detailed morphogenetic analysis reveals them in the characteristic layout of some quarters or in the layout of some streets of the town which have often maintained the old name of the village.

(3) The third type of suburban villages annexed by the town can be observed in Łódź.\* Two main periods can be distinguished in the history of Łódź:

A. The period of agricultural Łódź, a village from the 14th century (1332), and then a small town (laid out in 1414) until the first quarter of the 19th century.

B. The period of industrial Łódź, lasting up to the present.

To the south of the agricultural town a cloth-workers' settlement called *Nowe Miasto* (New Town) was planned in the first quarter of the 19th century. This settlement was built on arable and barren lands. The New Town was distinguished by a regular, geometrical pattern which recalled the Renaissance rules. The market place was the centre of the New Town and it was situated at the old cross-roads. The streets starting from the market place were sections

\* Data concerning this part of the paper have been taken from M. Koter's work [9].

of the old road network. At the same time modification of the layout of the Old Town began.

In the extension of the New Town cloth-workers' gardens were traced out and afterwards the new industrial settlement of *Łódka*, with weavers and spinners of flax, was added. The creation of the *Nowa Dzielnica* (New Quarter) was the next stage of the planned construction of industrial Łódź in 1840. In this way a regular pattern of streets arose.

In connection with the construction of industrial Łódź, two villages, Widzew and Zarzew, underwent layout modification. This action was connected with the removal of the population to villages not undergoing changes caused by industry. The re-planning of these two villages had only slight reference to the earlier spatial layouts and, as a matter of fact, it completely effaced the former village pattern.

The later development of industrial Łódź towards the west was related to the former field pattern. Więckowski, 22 Lipca, Strug and Kopernik streets follow the lines of former fields. The subsequent building-up of Łódź went on within the framework of the former field and road patterns.

At the end of the 19th century, with industrial enterprises no longer dependent on water power, the later development of industry moved towards the central town areas and not towards streams, as had been the case before. Factories arose wherever it was possible to buy free sites. In this way an element of spontaneity was introduced into the regularly-composed urban plan of Łódź.

Łódź is an interesting example of complicated relict layouts. The present layout of the town is the consequence of successive settlement processes. The old villages of Łódź (i.e. *Łodzia*, later called *Stara Wieś* or "Old Village", a loosely built-up chain village with a regular field pattern, and *Wólka*, *Widzew* and *Zarzew* villages) have completely lost their former spatial layout. Only the course of a few streets presents a relict character (for instance *Wrześnińska*, *Srebrzyńska*, *Miodowa*, *Żytnia*, *Piwna*, *Górna* streets) because they follow the course of former roads and reflect the boundaries of the oldest town fields and the characteristic bends of the former field-parcels.

These examples present three kinds of relict forms that are preserved in the spatial layouts of some Polish towns.

(1) Former suburban villages appearing in the vicinity of towns located and established contemporaneously with them in the Middle Ages. These villages, with specialized functions, such as vegetable growing, fishing, or weaving, appeared in the vicinity of Wrocław, Brzeg, Opole, Radom, Poznań, Kraków and elsewhere. At the time of the intensive urbanization of these areas, in the second half of the 19th century and at the beginning of the 20th, these villages disappeared. As far as the vegetable growers' villages are concerned, their functions have been taken over by villages situated further away from the town.

(2) Former agricultural villages rapidly transformed into industrial settlements in the 19th century and in the 20th century. Processes of this kind took place in the Upper Silesian Industrial Region, as for instance in Zabrze, Katowice and Sosnowiec.

(3) Former agricultural settlement on the area of which a town has been planned, or, as in the case of Widzew and Zarzew near Łódź, two settlements which have undergone a complete transformation and which have been enlarged and re-planned. Such villages also experienced change in the social and occupational composition of their population as they became settlements of people working in industrial plants. On the other hand, evidence of former

villages, visible in the spatial layout of towns is preserved only in the course of some streets which follow the direction of former field boundaries and parcels, as well as the course of ancient roads, for instance in Łódź.

The relict forms which have been mentioned and which have persisted in the spatial layout of some Polish towns, do not include, of course, all the possible variants. They indicate the necessity for morphogenetic research work in urban areas. The study of the genesis and of the subsequent transformation of ancient relict settlements absorbed by towns explains the elements of historical stratification with in their present spatial layout.

Institute of Geography PAN, Warsaw

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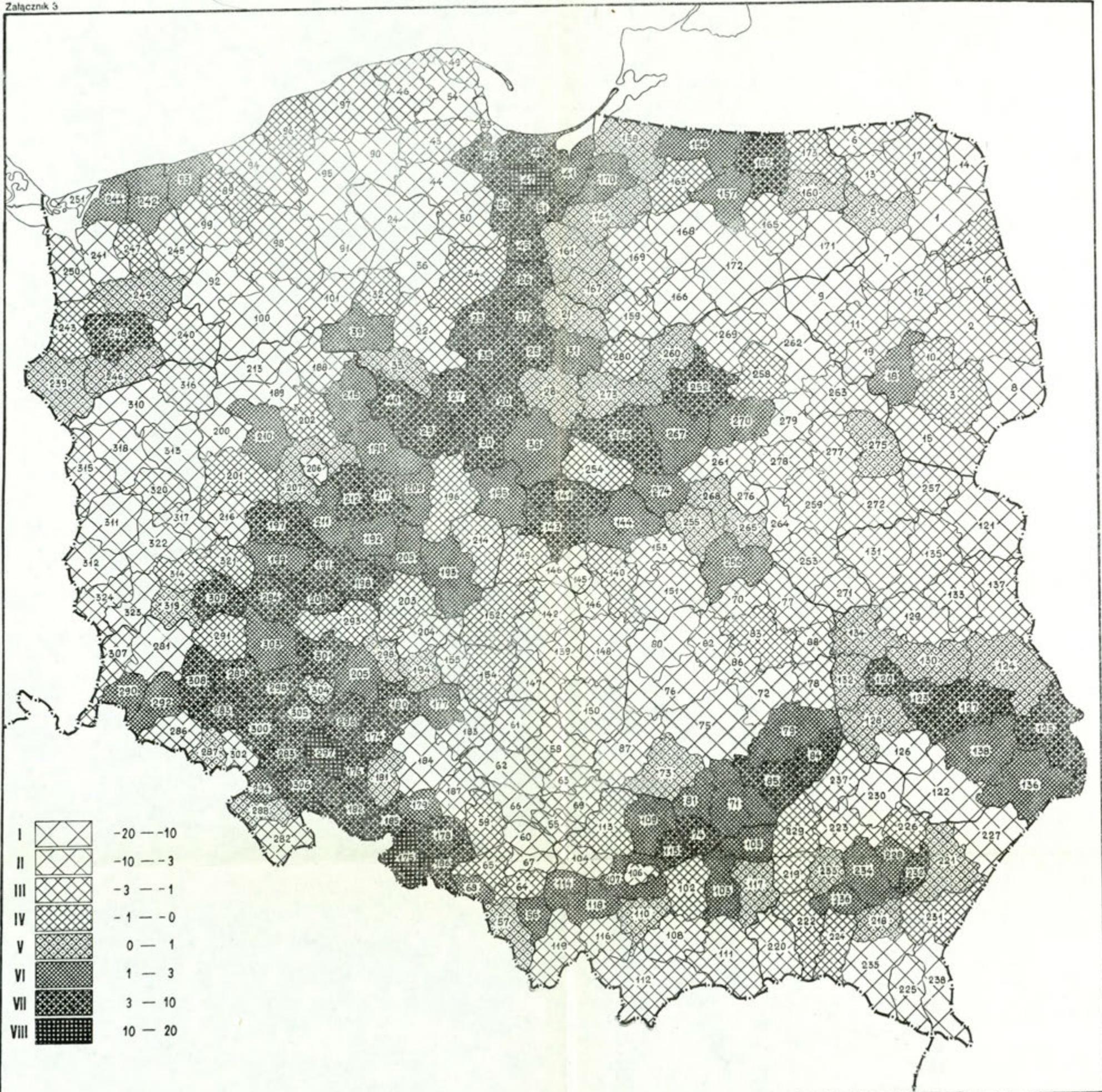
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Fig. 1. Key to area units adopted for factor analysis





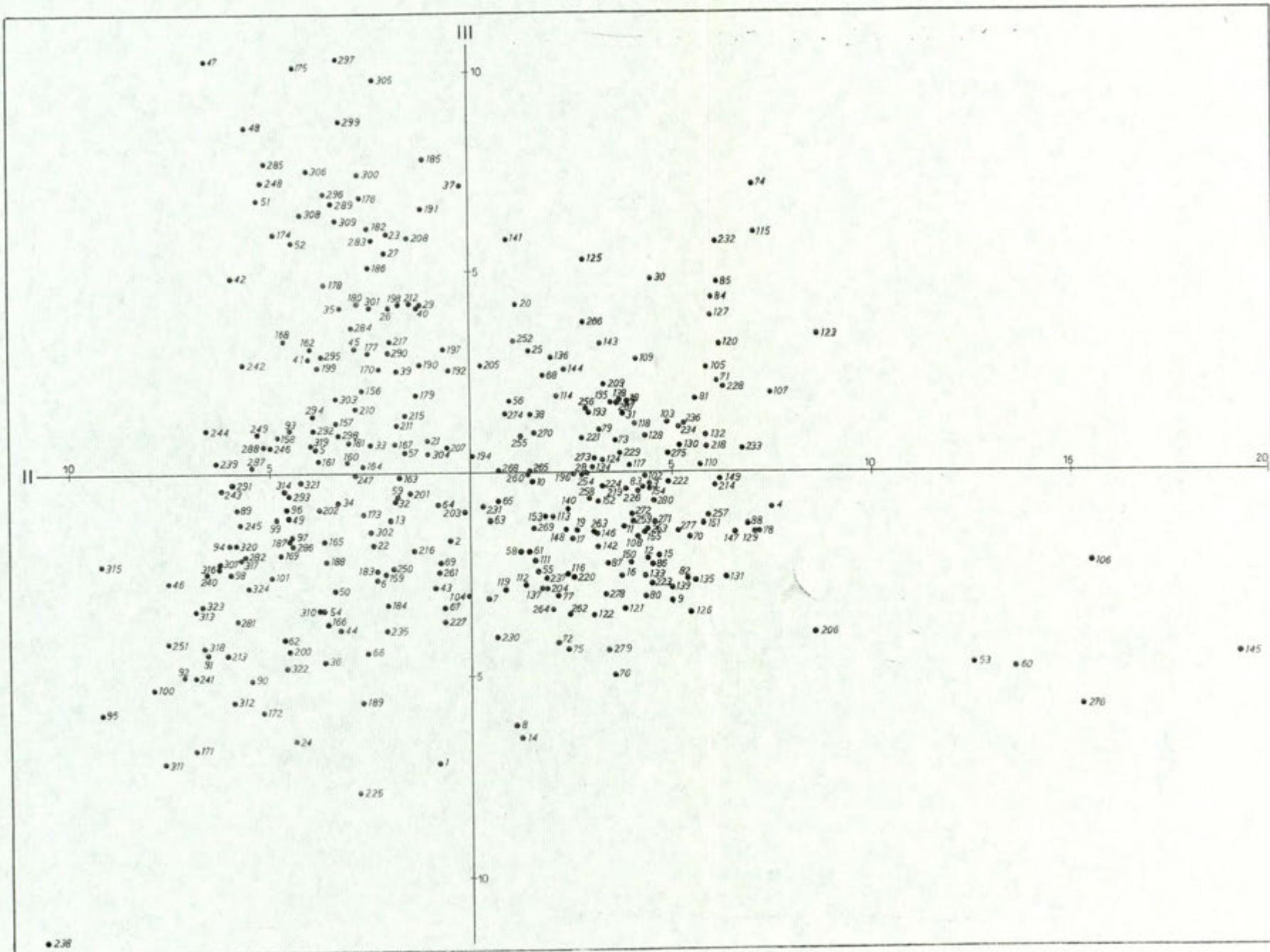


Fig. 4. Topology in a two-factor system

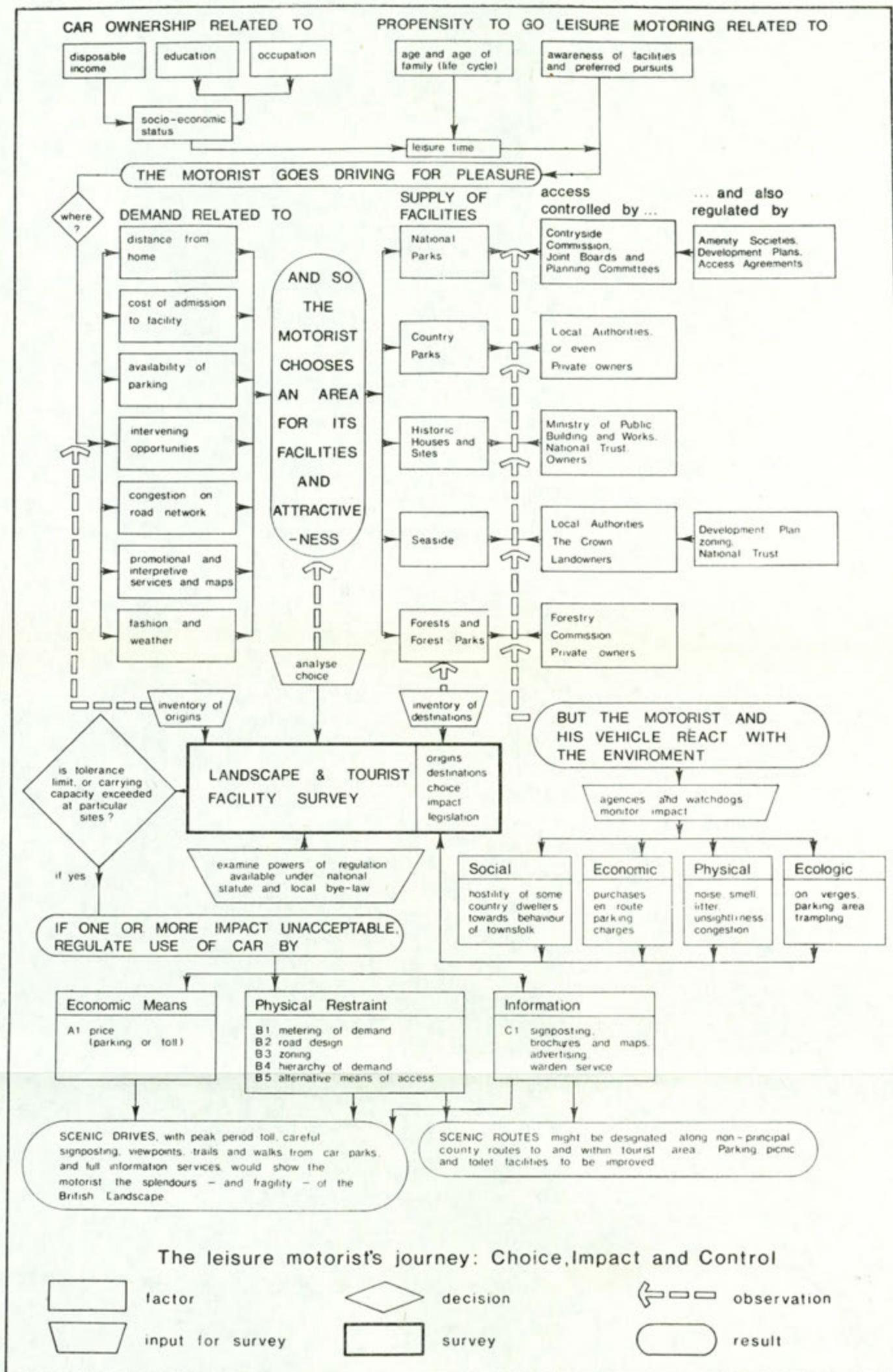


Fig. 4. The leisure motorist's journey: choice, impact and control

Source: British Railway Timetables, 1966

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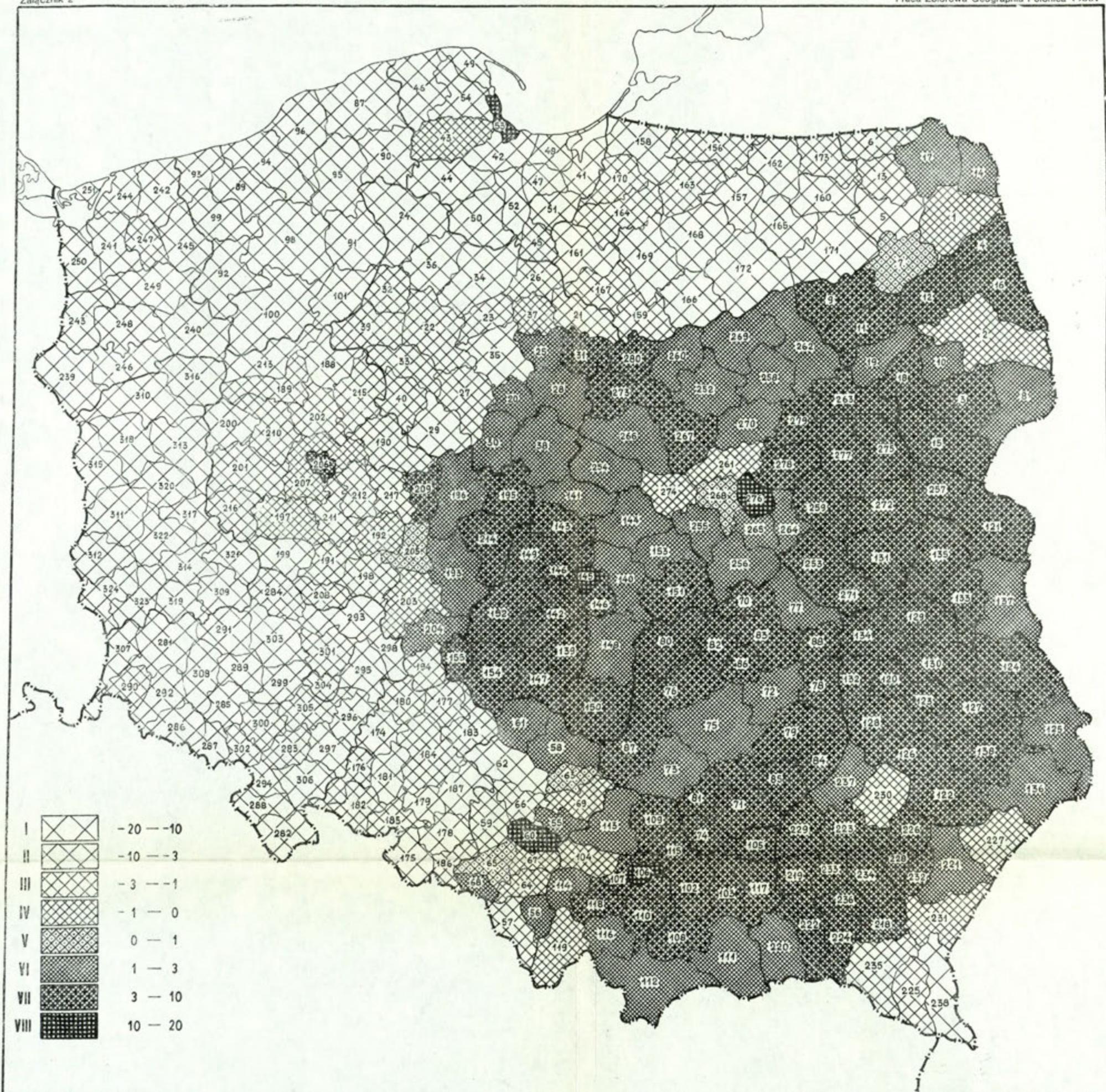


Fig. 6. The spatial distribution of the scores of the factor "level of urbanization and industrialization" (F<sub>1</sub>)

