CONTACT POTENTIALS IN THE EUROPEAN SYSTEM

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CONTRIBUTIONS TO THE METROPOLITAN STUDY:

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FOREWORD

The Metropolitan Development Project was initiated in 1983 as a collaborative study. In 1984 efforts have been concentrated on creating a methodological basis for a more focused research phase starting in 1985. One of the priorities is to analyze the contact and accessibility problems of metropolitan regions.

This paper contains an empirical study of differences in airline contact potentials of a large number of European metropolitan regions. The calculations show that accessibility as defined is very high in Paris, Amsterdam, Frankfurt, Zürich, and West Berlin, while being remarkably inferior to Vienna, Rome, Madrid and Stockholm. With the exception of East Berlin, Warsaw and Moscow, Eastern Europe has lower European accessibility than Greece and Portugal. Analyses of metropolitan development possibilities will profit from the use of these measurements.

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CONTENTS

1 THE ÖRESUND PROJECT

The Öresund Channel, or "the Sound", is the name of the narrow, crowded sound that constitutes the boundary between Denmark and Sweden. Advanced plans for building a bridge across it, as well as a tunnel beneath it, have been in existence for several years now. A great amount of investigation material has been produced, and the Governments and Parliaments of the two countries concerned will shortly determine whether these connexions will be established in the course of the 1980's. A few studies taken from those Sound investigations will be touched on in the present paper. These studies aim to throw light on the potential effects on business companies and households of bridge/tunnel connexions between Denmark and Sweden. In addition, the possible consequences for the bio-physical environment on both sides of the Sound were taken into account.[1]

The Öresund project contains extensive surveys of the sales and purchases of goods and services on the part of Danish and Swedish companies. The information flows that travel by the way of direct personal contacts among officials on various levels - in companies, and in other organisations - are also registered. The material comprises international as well as national communication patterns.

The studies demonstrate that the Sound constitutes a very definite barrier today. Companies on the Danish and Swedish sides of the Sound have a limited trade exchange and astonishingly few contacts with one another. The Danish and Swedish spatial organisation of sub-contractors, as well as the distributional systems, are closed circuits when viewed in relation to each other. The interesting thing is that the barrier has been growing in recent years. It was far less noticeable before, and shortly after, the Second World War. This is not to say that the total amount of Swedish-Danish trading has decreased. The reduction has taken place in the exchange of goods and contacts in the border areas on both sides of the Sound.

Investigations have shown that the lack of inter-action across the Sound is <u>not</u> primarily a consequence of transportation problems. Instead, administrative codes and routines, combined with the regional structure of various organisations and with inter-company connexions, constitute the main cause for the present state of affairs.

On the Danish side, Copenhagen is a vital controlling centre for Danish business, besides forming an important node in international contact systems. A great majority of Copenhagen's administrative and organisational relationships are directed towards the West. Compared to Copenhagen, Malmoe on the Swedish side is a typical subsidiary region. Relationships are set in a north-easterly direction, towards the central parts of the Swedish national territory. Associations with Stockholm are all-important. In a Danish-Swedish perspective, only Copenhagen and Stockholm are found on the same "contact level".

The development in the Sound area corresponds to certain trends that can be observed in the rest of Europe. After the Second World War, contacts between border areas in different countries often deteriorated in consequence of various processes of concentration that have taken place in business and in a number of organisations. In earlier days, autonomous local units maintained contacts across the boundaries. Today, these local units have frequently been transformed into affiliated offices, controlled and administered from a main office situated in some other city. The main offices take charge of any international relationships.

In two of the studies conducted under the auspices of the Öresund project, the whole of Europe forms the focal point of interest. One of them will be dealt with in greater detail later on; it discusses contact and travel facilities in Europe as a whole. This study can be viewed as an example of the inquiries that have been made concerning the possibilities and the spheres of action on the part of the companies - in this particular case their possibilities of maintaining direct personal contacts in the European system of cities. Thus, this study is devoted to purely objective and easily quantifiable matters. The second study, only to be touched on in passing, represents an entirely different approach in the investigation. Here, the question of how business managers and other decision-makers regard their own situations supplies the point of departure.

The concept "environmental image" is used as a designation covering the subjective attitudes to, and knowledge of, various abstract and concrete matters in the company's environment on the part of administrative officials. This environmental image is assumed to affect every decision made, whether in business companies or in other organisations. Environmental images are mapped out in the course of detailed interviews with the managers of big companies in Denmark and Sweden. They were asked to assess different European countries

with regard to their respective political stability, linguistic difficulties, business freedom and efficiency, trade barriers, product quality, technological standards, capacity for innovation, negotiating climate, and the extent to which signed treaties and agreements are honoured. They also stated to what degree they feel themselves to be conversant with current affairs in other countries.

The investigations display great similarities in the way that Swedish and Danish decision-makers regard Europe. Differences are mainly connected with the evaluation of the respective neighbouring country. For instance, both groups regard domestic business as being highly efficient. Swedish decision-makers, however, are less convinced of the efficiency of Danish industry. Of the Northern European countries, only Great Britain's industry is held to be less efficient than that of Denmark. Swedish decision-makers make somewhat unfavourable assessments of other aspects of Denmark, too, such as the negotiating climate. By way of a further instance, Swedish decision-makers think that Danish enterprise is more severely regulated and subject to national supervision and control than Swedish industry. Danish decision-makers hold the opposite view.

The managers also stated their opinions on the Swedish and Danish parts of the Sound region. To sum up the results very briefly, the investigations show that decision-makers are certainly familiar with their own half, the other half being less well known. The latter is "abroad", and the image instantly becomes less clear-cut. It might perhaps be said that the tendency towards stereotype ideas and clichés grows as soon as one is put to judging the state of affairs on the other side of a national border. Considering that it is in fact a "neighbour" of the Malmoe region, the image of the Copenhagen region in the minds of Swedish decision-makers is unfocused where actual knowledge is concerned. It resembles the images of the most peripheral regions in Sweden more than it does the image of a metropolis just across the water. It is true that the image of the Copenhagen region is more complete than those pertaining to other foreign regions, but that does not alter the fact that the situation is most surprising.

The investigations presented in the Öresund report indicate the remarkably uniform ideas and judgements regarding the factors surrounding business and manufacturing firms on the part of Swedish decision-makers. The environmental

images of Danish decision-makers agree with one another to a corresponding extent. This uniformity is probably a consequence of a series of circumstances, some of which we are aware of. Promiment decision-makers in big companies have all had much the same training and education. Their professional careers are very much of a kind. They read the same newspapers and magazines. Their exchange of information, and their personal contacts, take place within the same national - in some cases international - contact network.

2 THE POST-INDUSTRIAL SOCIETY

As was stated above, the remainder of the present discussion will deal with contact and travel facilities in the European urban system. In order to facilitate an understanding of the purpose of this study, a background sketch of some kind is called for. A brief description of the altered employment structure and the likewise altered transportation requirements that are characteristic of post-industrial societies might serve those ends.

For a deeper understanding of the far-reaching structural changes which have taken place in occupational composition, it is necessary to depart from the accepted division of employment into industrial, trade and service sectors. In this survey occupational activity in society will instead be regarded as a fabric of job functions. These are to be found in varying numbers and in varying combinations within the different types of workplaces which together constitute the private and the public sectors of the economy.

In a functional view of employment, the fact that the job assignments carried out at the same workplace differ among themselves is taken into consideration. This is important, since division of labour and specialisation have often been carried to great extremes today, even in the single company and at its various workplaces. The most significant characteristics of the development in post-war societies towards increasing division of labour and specialisation cannot be subjected to detailed scrutiny unless the employees are grouped according to their job functions.

Figure 1 shows two workplaces. One of them represents a service company (production of services) and the other a company taken from the manufacturing industry (production of materials. The sketch can be used for the description of units in the private as well as the public sector. The circles denote the control units or administrative functions of the companies, the

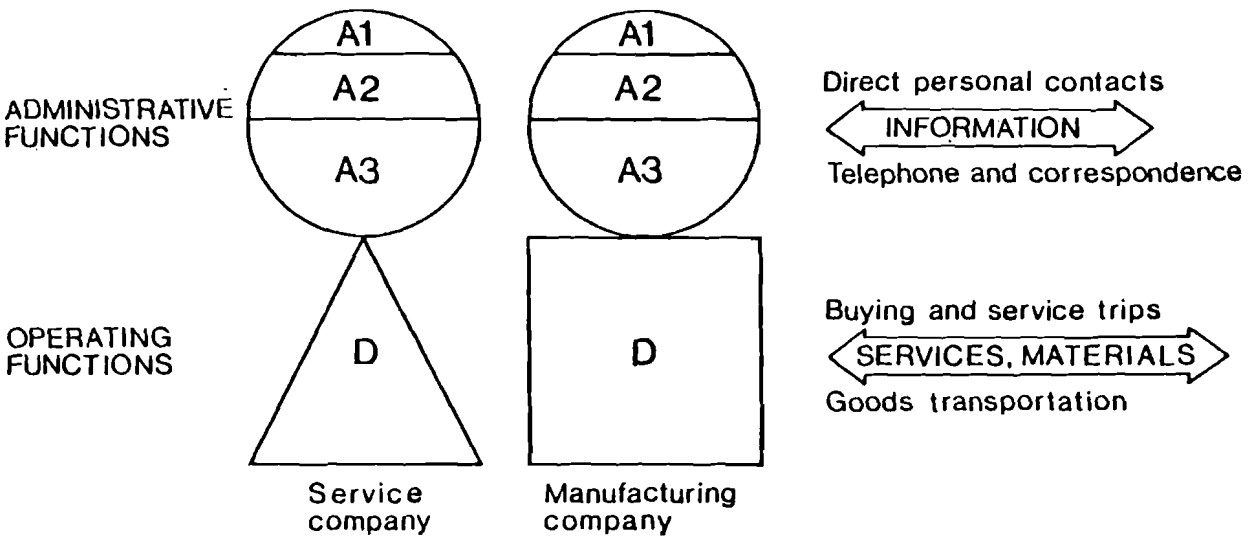

Figure 1. Job functions connected up by links and flows.

triangle and the square standing for the operating units or manufacturing functions respectively. The proportion between control units on the one hand and operating units on the other varies among different organizations. Purely administrative bodies consist of circles only, whereas pure warehouse units and workshops are almost exclusively made up of triangles or squares.

The job assignments given to employees within the company constitute one starting-point for functional categorisation. The control unit comprises supervising and administrating assignments. Officials employed in prominent administrative positions are responsible for decision-making, planning, negotiations, search, and product development, etc. They are referred to as A1 in the figure. The A2 stratum contains control, direction of production, processing of information, and services to A1, etc. A3 contains accounting, routine office work, services to A1 and A2, etc. D stands for the operating units of the companies concerned. In the manufacturing industry, for instance, operational staff is mainly employed in handling goods. This frequently entails shop-floor work. In service companies, the operating units consist of nursing staff, shop assistants, mechanics, installation engineers, and drivers, to mention a few examples. In this context, it should be pointed out that it is often difficult to distinguish clearly between administrative functions and the operational functions of certain service companies.

The second starting-point for functional categorisation is found in the kind of contact that forms the primary link between a job function and its environment (see the kinds of contact to the right in Figure 1). The administrative functions are in charge of the exchange of information between the companies and other organisations. Hence, they are associated by means of information flows in varying directions. The A1 function is mainly dependent on direct personal contacts. Investigations show that this type of employee - in industrial companies, service companies, and public administration - is involved in extremely comprehensive contact work. On the average, these employees devote 30 to 50 hours a week to direct personal contacts, some of them more than 60 hours (including travelling time, but not pre-travel preparation time).

The A2 functions do less comprehensive contact work, some 10 to 30 hours a week. A3 members have relatively few direct personal contacts outside their own workplace. In the A2 and A3 functional groups, contacts via telephone and correspondence form the most important kind of contact from a quantitative point of view. Operational functions (D in Figure 1) in manufacturing

companies are linked by goods transportation. The operating units of service companies and retailers are associated with companies and households in their surroundings by means of buying and service trips.

The activity systems in countries which can today be described as post-industrial societies - e.g. the United States, Japan, Canada, Switzerland, West Germany, France, Great Britain, the Benelux and Scandinavian countries - have undergone a process of radical transformation. To put it simply, these changes can be described as pronounced shifts in occupational structure from the primary functions typical of an agrarian society, to the manufacturing functions typical of the industrial society, and finally to the service functions and administrative functions which account for a considerable proportion of gainful employment in the post-industrial society.

In all probability, these changes in the structure of employment will be accentuated in the future. The primary and manufacturing functions will need fewer and fewer workers. The service occupations requiring personal attention with direct personal contacts will engage an ever-increasing proportion of the labour force. Employment will rise very rapidly in the administrative functions, which are characterised by the complicated processing of information, decision-making, planning, research and product development.

So far, the structural changes described here have gone hand in hand with a great concentration of job opportunities and residential facilities in major urban regions throughout the world. Especially in developed economies, the growth of major cities is largely the result of the dynamic expansion of service and administrative functions. The head offices of companies are concentrated in the major urban regions. There we find the administrative and management personnel of trade unions and other interest organisations, financial institutions, and a large proportion of the growing public administration sector. Around these control-unit agglomerations congregate every imaginable type of service, plus radio and television corporations, newspapers, publishers, etc.

Development in the post-industrial society has led to a far-reaching division of labour and specialisation. As a result of this, the interdependence of various work functions has increased considerably. Society cannot function without the constant transit of goods, people and messages. In view of this

survey's limited area of study, it is essential to observe how interest in the transport movements and flows that link different activities together has shifted (see right hand side of Figure 1). Formerly, attention was focused on the transportation of goods and the costs entailed. In addition, early studies of buying habits and service travel showed the comparatively limited transportability of people. During recent years we have become more aware of the necessity for a more detailed study of the information flows which link different activities together. Consequently, we now have a foundation on which to base a meaningful discussion of the factors governing location decisions of various administrative functions in the post-industrial society.

Information flows via telecommunications and correspondence can hardly affect the location of various activities. Physical distance is hardly an obstacle any longer for these types of information transmission. The essential point in this context, however, is that the most important information exchanged in society still requires face-to-face meetings, in spite of the rapid advance of telecommunications. In fact, it appears that direct personal contacts - on which physical distance imposes considerable constraint - have gained in importance during recent years, and may perhaps become even more important during the foreseeable future on account of the increasing complexity of society.

In various organisations employees with contact intensive functions, or employees whose duties depend very much on contact activity, are constantly on the move in order to receive and communicate information. They generate a considerable amount of the traffic in the central parts of the major urban regions. In the case of inter-regional travel, they account for 80 per cent of all journeys by air and about the same proportion of first-class train travel. The inter-regional contact network is dominated by the major urban regions both as the origins and destinations of journeys.[2)]

3 ACCESSIBILITY IN THE EUROPEAN SYSTEM OF CITIES[3)]

The following analysis of the contact and travel facilities in the European system of cities should be regarded as a study of physical range and nothing else. Those organisational barriers and psychological obstacles to information which are known to exist between different countries and peoples (see

the introduction to the present paper) have been left out of account. However, plans have been made for considering the problem of European barriers of varying kinds in future research.

The foregoing discussion of contact patterns in Sweden and other countries has emphasized the role of the principal urban nodes in the national information web. An extension of the study to the international level poses the immediate problem of identifying the appropriate European system of cities for the analysis of international information webs. It is, of course, impossible to regard any such system as closed for there will be many flows across its boundaries. Most large European cities, for instance, are in frequent direct contact with American cities. Beyond the immediate periphery of Europe, in North Africa, for example, are cities which communicate as much with the urban nodes of Europe as they do among themselves.

Many studies have indicated the tendency for specialised occupational groups and decision-makers to congregate in the upper echelons of the labour market hierarchy, i.e. in the big cities and particularly in their central areas. Here are to be found the principal and regional offices of central and local government, of public and private industry, and of "pressure groups" such as employers and trades union organisations. Hence these cities should represent the most important elements in the contact network. Therefore all European capitals and cities down to the size of 500.000 have been included in this study.

Accessibility to these nodes depends, however, on their proximity to airports and the distribution of these means some modification to the choice of nodes. Bonn and The Hague, for example, have been excluded since they do not have their own international airports. They share their air traffic with Cologne and Amsterdam respectively. Additionally, seven other urban centres are included due to their functions as important international and regional centres.

The study comprises a total of 98 European urban centres. Their names are found in Table 1. The population figures in the table were taken from The Europa Year Book, usually denoting those city regions, or urban regions, where the various centres are situated. The numbers given to the centres in the table correspond to the numbers on the map of Europe (Figure 2).

Table 1 Population in urban regions

Nation	Numbers of urban regions	Centres	Population (millions)
Albania	1	Tirana	0,17
Austria	2	Vienna	1,61
Belgium	3	Brussels	1,08
	4	Antwerp	0,67
Bulgaria	5	Sofia	0,95
Czechoslovakia	6	Prague	1,09
Denmark	7	Copenhagen	1,36
	8	Aarhus	0,25
Finland	9	Helsinki	0,80
France	10	Paris	8,20
	11	Lyon	1,07
	12	Marseille	0,96
	13	Lille	0,88
	14	Bordeaux	0,56
	15	Toulouse	0,44
	16	Nice	0,39
	17	Nantes	0,39
East Germany	18	East Berlin	1,09
	19	Leipzig	0,57
	20	Dresden	0,51
	21	Erfurt	0,20
West Germany	22	West Berlin	2,05
	23	Hamburg	1,75
	24	Hanover	0,51
	25	Bremen	0,58
	26	Düsseldorf	0,63
	27	Stuttgart	0,63
	28	Munich	1,34
	29	Cologne	0,83
	30	Nuremberg	0,51
	31	Frankfurt a.M.	0,66
Greece	32	Athens	2,54
	33	Saloniką	0,56
Hungary	34	Budapest	2,05
Iceland	35	Reykjavik	0,10
Ireland	36	Dublin	0,65
Italy	37	Rome	2,83
	38	Milan	1,74
	39	Naples	1,22
	40	Turin	1,18
	41	Genoa	0,81
	42	Palermo	0,66
	43	Bologna	0,49
Luxemburg	44	Luxemburg	0,08
Holland	45	Amsterdam	1,02
	46	Rotterdam	1,06
Norway	47	Oslo	0,47
Poland	48	Warsaw	1,39
	49	Cracow	0,66
	50	Wroclaw	0,56
	51	Poznan	0,50
	52	Katowice	0,31
	53	Gdańsk	0,61
Portugal	54	Lisbon	1,61

	55	Oporto	1,31
Rumania	56	Bucharest	1,64
Spain	57	Madrid	3,15
	58	Barcelona	1,75
	59	Seville	0,55
	60	Valencia	0,65
	61	Zaragoza	0,48
	62	Bilbao	0,41
Switzerland	63	Zurich	0,72
	64	Geneva	0,32
	65	Berne	0,29
Sweden	66	Stockholm	1,35
	67	Gothenburg	0,69
	68	Malmoe	0,45
Turkey	69	Istanbul	2,38
United Kingdom	70	London	7,34
	71	Birmingham	2,37
	72	Glasgow	1,73
	73	Liverpool	1,26
	74	Manchester	2,89
	75	Leeds	1,73
	76	Newcastle	0,81
	77	Edinburgh	0,45
	78	Belfast	0,55
Yugoslavia	79	Belgrade	1,21
	80	Zagreb	0,60
The Soviet Union	81	Moscow	7,41
	82	Leningrad	4,13
	83	Kiev	1,83
	84	Baku	1,34
	85	Kharkow	1,31
	86	Minsk	1,04
	87	Odessa	0,96
	88	Tbilisi	0,95
	89	Donets	0,92
	90	Kazan	0,92
	91	Volgograd	0,87
	92	Rostov	0,85
	93	Riga	0,77
	94	Zaporozhe	0,71
	95	Lvov	0,59
	96	Tallinn	0,39
	97	Vilnius	0,41
	98	Kishinev	0,42

From "The Europa Year Book" (1975).

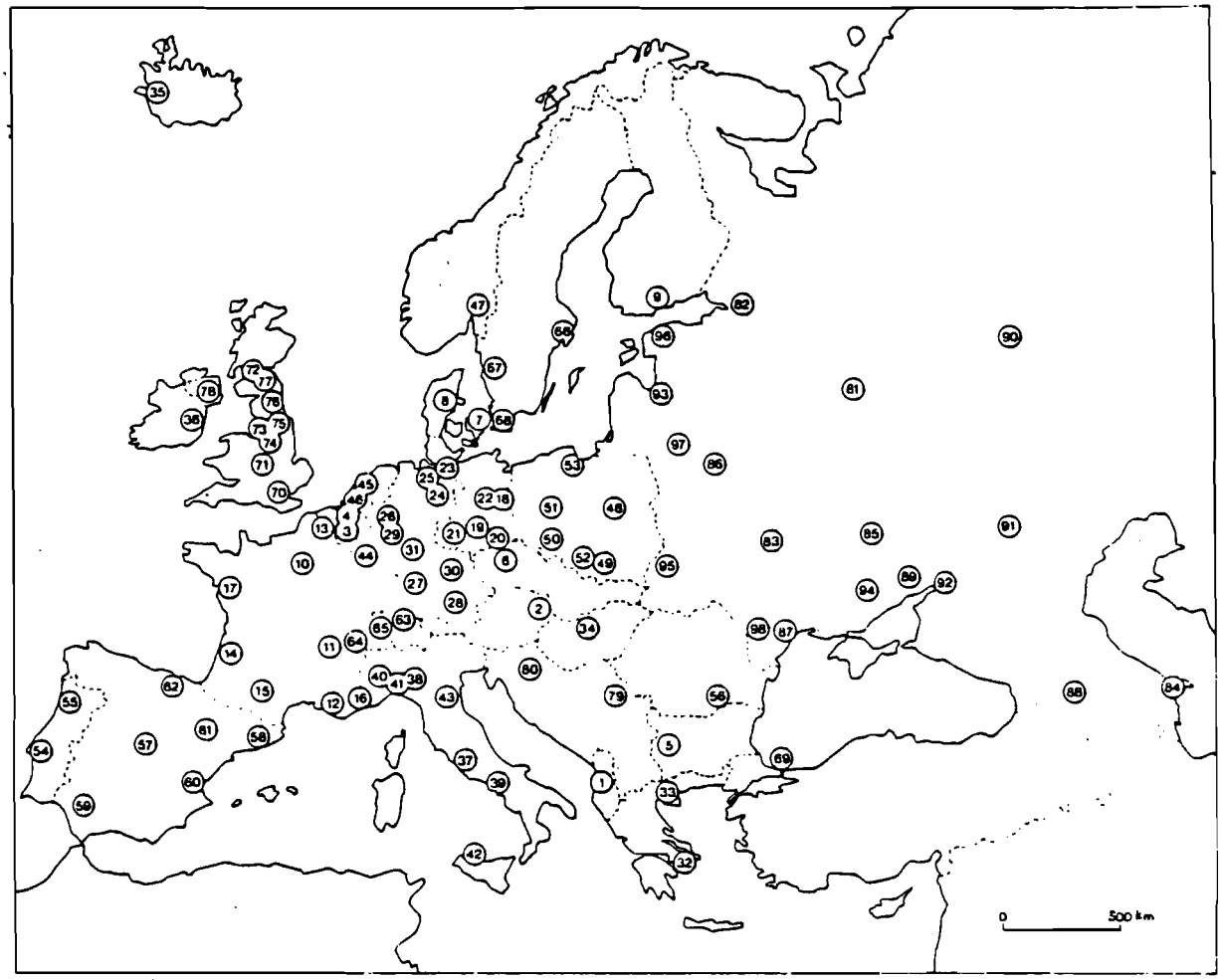

Figure 2. Urban regions included in the study (Names and numbers in table 1).

In the study of accessibility in Europe, different attempts have been made to investigate the opportunities for face-to-face contacts. On the following pages, attention is focused on two such attempts dealing with opportunities for direct personal contacts between 98 European urban centres. The first study investigates the different possibilities of round trips in a given day by different means of transport (car, train, boat and airplane) between each of the urban centres. The maximum duration of stay within the destination centre which still permits the person concerned to return home on the same day is used to evaluate these possibilities. The study is divided into two portions: the opportunities for face-to-face contacts from each urban centre to all other centres are reported first (the term outbound accessibility is used in this case). The corresponding reverse opportunities form the second portion of this investigation (the term inbound accessibility is used in this case).

The second major investigation (see section 4) focuses on the relationship between the maximum duration of stay within a work day on the one hand and the size of urban population on the other. Two questions are put forward: what is the potential number of individuals who can be reached from city A during a day visit of x hours' duration, and what is the potential number of individuals who can travel to city A during a day visit of x hours' duration? The data obtained from these two questions are used as measures of the outbound and inbound accessibility for each urban centre.

The first major study investigates the different possibilities of round trips in a single day by different means of transport between each pair of the 98 European urban centres. The duration of stay is the measure used to evaluate these possibilities. It is assumed that the departure from the home centre does not occur prior to six o'clock in the morning, and that return is before midnight. Furthermore, these day trips must be possible at least three times between Monday and Friday.

The investigation examined the transport possibilities in Europe during Spring, 1976. Data for train and air travel are derived from the Thomas Cook Continental Timetable and the ABC World Airways Guide. The work procedures used to evaluate the European outbound and inbound accessibility are:

1. The maximum duration of stay within the destination centre which still allows the person concerned to return to the home centre on the same day is calculated for each pair of the 98 urban centres.

2. The results from the calculations, whenever exceeding 9.500, are entered into a 98 x 98 matrix.

3. The values of the matrix are summed by row and column.

The row totals in the 98 x 98 matrix are used as measures of outbound accessibility, while the column totals determine the inbound accessibility for each of the 98 cities.

3.1 Outbound accessibility

Figure 3 illustrates the fact that the most favourable zone for outbound accessibility occurs within an area delimited by lines drawn between Paris-London-Hamburg-Munich-Milan-Lyon-Paris. The only urban centres to show correspondingly high values outside this delimited area are: West Berlin, Vienna, Rome, and Manchester. This high accessibility area is called the "Primary European Centre". The values for the urban centres within this area show variations, but as seen from Figure 3, they constitute a reasonably homogeneous block.

Outside the "Primary European Centre", cities in Scandinavia, the British Isles (excluding London and Manchester), and the South and West of France form three relatively homogeneous accessibility blocks. The urban centres within these three zones hold an intermediate position in terms of their outbound accessibility and are referred to as the "Intermediate European Centres".

The only urban area having a value corresponding to the "Intermediate European Centres", and falling outside these three blocks, is Madrid. As transpires from the map, the variability in outbound accessibility in the rest of Europe is large. The values vary between 0 and 30. Therefore, within this "low accessibility area" there are different degrees of secondary positions. The urban centres within this zone are referred to as the "Secondary European Centres". Another striking feature emerging from this map is the major difference in values between Eastern and Western European Centres, well illustrated in the East and West German case.

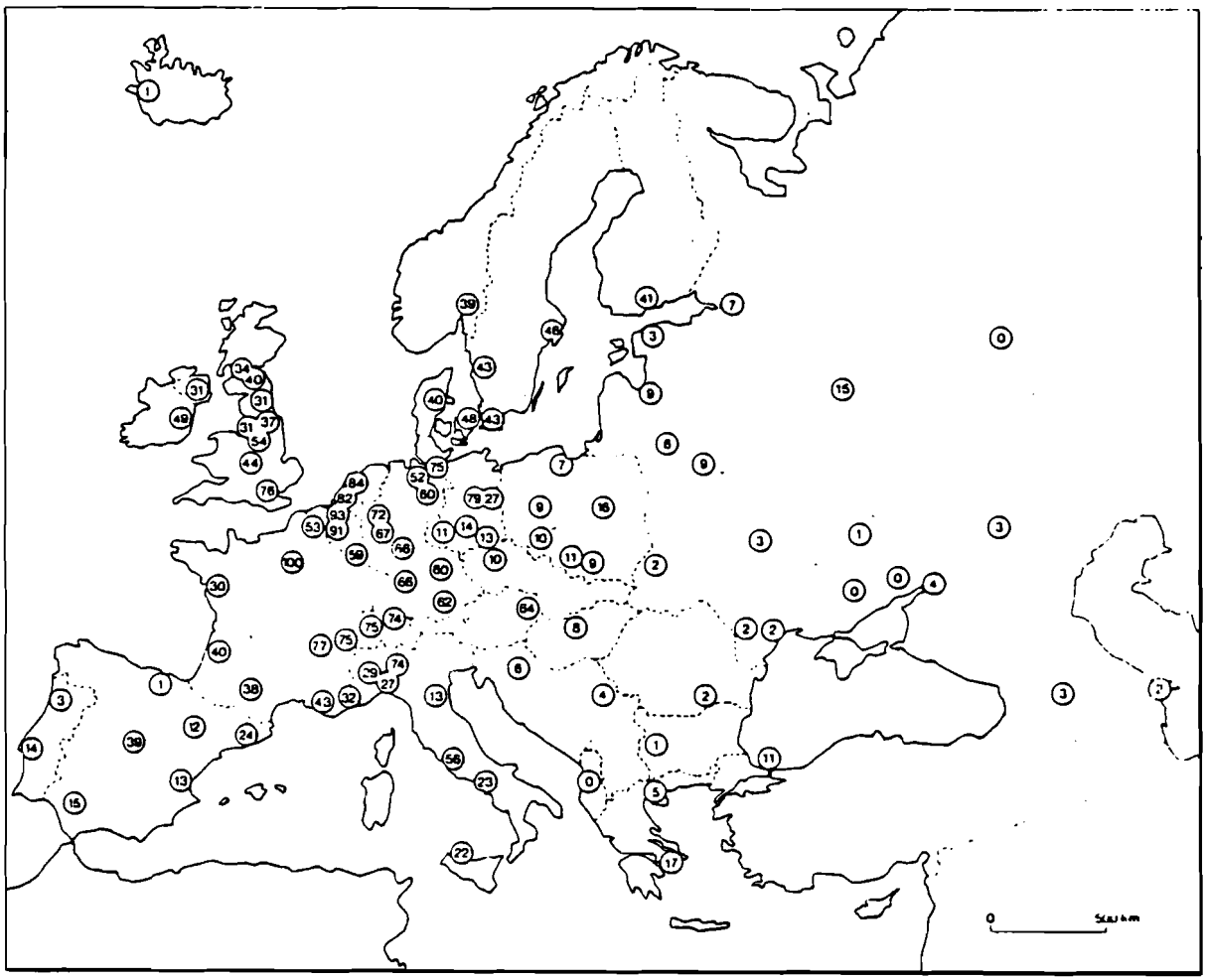

Figure 3. The European stay time (duration of stay) map: outbound accessibility. The values are expressed relative to the most accessible urban centre (Paris = 100).

3.2 Inbound accessibility

The inbound accessibility map (Figure 4) shows that most urban centres belonging to the "Primary European Centre" have equally favourable positions regarding their inbound travel. A striking change in ranking occurs for Copenhagen. It now belongs to this group. Thus, Copenhagen has considerably better inbound than outbound accessibility within Europe.

The urban centres belonging to the three blocks previously called the "Intermediate European Centres" still keep their positions in relation to the "secondary" cities. But as their overall values are lower when compared to the "Primary European Centre", the inbound accessibility of these blocks is lower than their outbound accessibility. The opposite is true of some places in the "Secondary European Centres" category (e.g. Barcelona, Genoa, Zagreb and Warsaw). The outbound accessibility values of these cities are now comparable to those of the "Intermediate European Centres". Again, the differences in values between Eastern and Western European centres remain.

3.3 Accessibility: Inbound or outbound?

Most models of spatial interaction and connectivity do not distinguish between inbound and outbound accessibility. As is evident from Figures 3 and 4, however, the inbound and outbound accessibilities in the European duration-of-stay maps are different. This phenomenon will always occur because of the scheduling of transport. In spite of the differences, the two maps have many features in common. It is obvious that the "Primary European Centre", the "Intermediate European Centres", and the "Secondary European Centres" basically contain the same urban centres regardless of whether outbound or inbound accessibility is being considered.

A numerical comparison between the individual values of the two maps shows some striking differences, however. One of these is that a majority of the urban centres have a relatively higher outbound than inbound accessibility. This is especially true of urban centres in the "Intermediate European Centres", and in the "Secondary European Centres". This disparity can to a great extent be explained by the construction of the time tables. Thus, the existing schedules of train and air traffic in Europe seem to be planned in such a way that there are better opportunities for travelling into the "European Centre" than in the opposite direction.

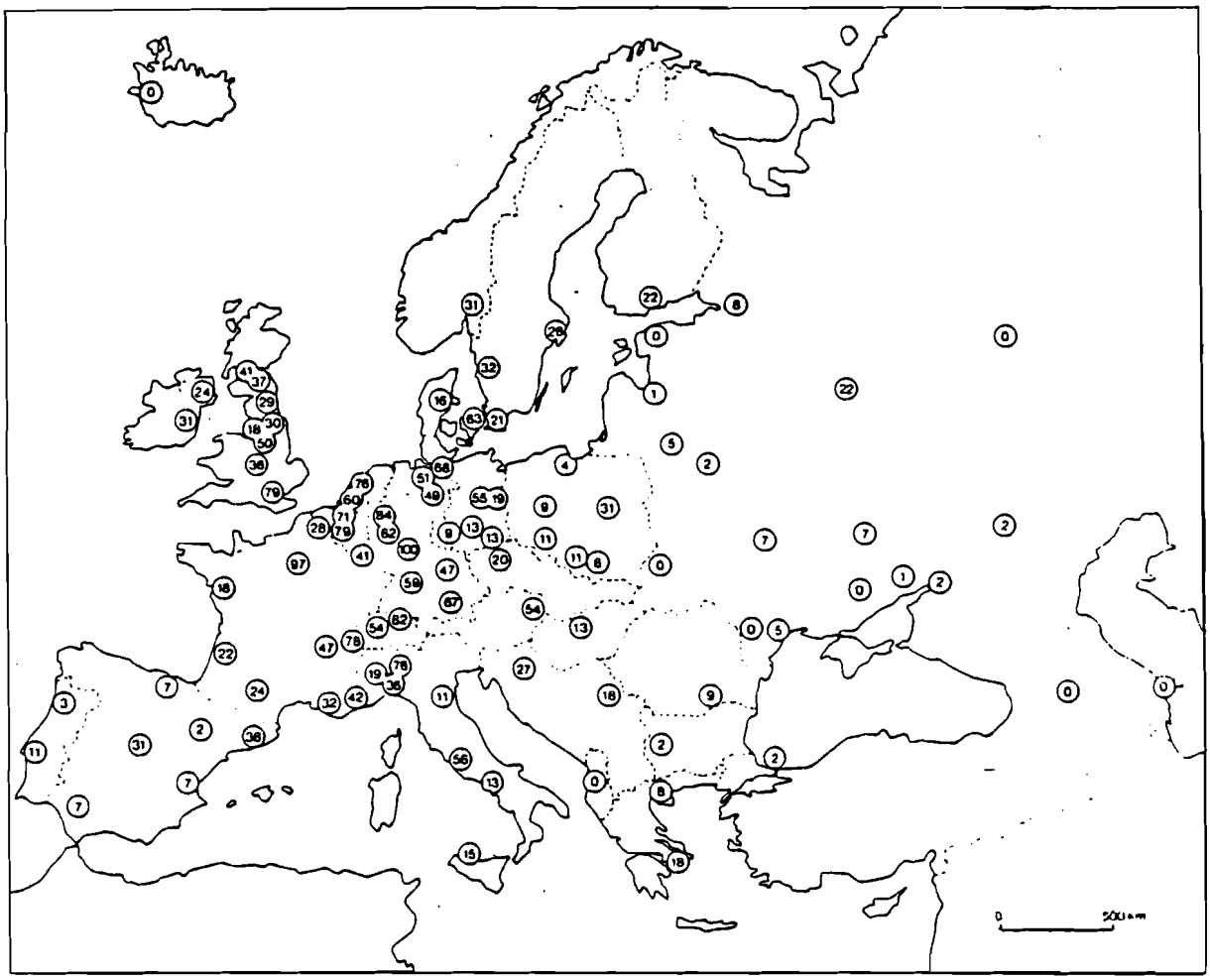

Figure 4. The European stay time (duration of stay) map: inbound accessibility. Values are expressed relative to the most accessible urban centre (Frankfurt = 100).

4 THE EUROPEAN POTENTIAL CONTACT MAPS

To obtain quantitative expressions of the outbound and inbound accessibility of the 98 urban centres, the relationship between the maximum duration of stay and the size of each urban population is investigated. The population of each urban agglomeration is thus used as a surrogate for the contact requirement (the need for contacts), as it is impossible to find data for the actual number of contact-intensive employees in most of the city regions. When using this surrogate measure for contact requirement, a linear relation between city size and contact requirement is accepted. In Sweden we know, however, that reality is not like that, as the big cities normally have a higher percentage of their employees in contact-intensive jobs than the smaller ones. A more adequate surrogate measure of contact requirement could have been constructed. One suggestion would be to calculate an index of contact requirement for each city in which factors like being a capital or not, the presence of headquarters of national firms and organisations, and the presence of multinationals, together with city size, could be incorporated. Calculating such an index, however, calls for a lot of data which are not available at the moment.

To evaluate the contact accessibility of Europe, two questions need to be answered:

- What is the potential number of individuals (out of about 120 million in the 98 urban centres) who can be reached from a given urban centre during a day visit of x hours duration?

- What is the potential number of individuals who can travel to a given urban centre during a day visit of x hours' duration?

The population figures required for answering these two questions were collected collected from The Europa Year Book. Data concerning the maximum duration of stay in each urban centre were taken from the 98 x 98 matrix described in the first study. The answers to the two questions are summarised for each centre through the construction of so-called location profiles. Figures 5 and 6 show, as an example, the location profiles for Paris, Copenhagen and Malmoe. Figure 5 shows the potential number of individuals who can be reached from Paris, Copenhagen and Malmoe during a day visit of varying duration. Figure 6 shows the potential number of individuals who can travel to these cities during a day visit of 1-18 hours' duration.

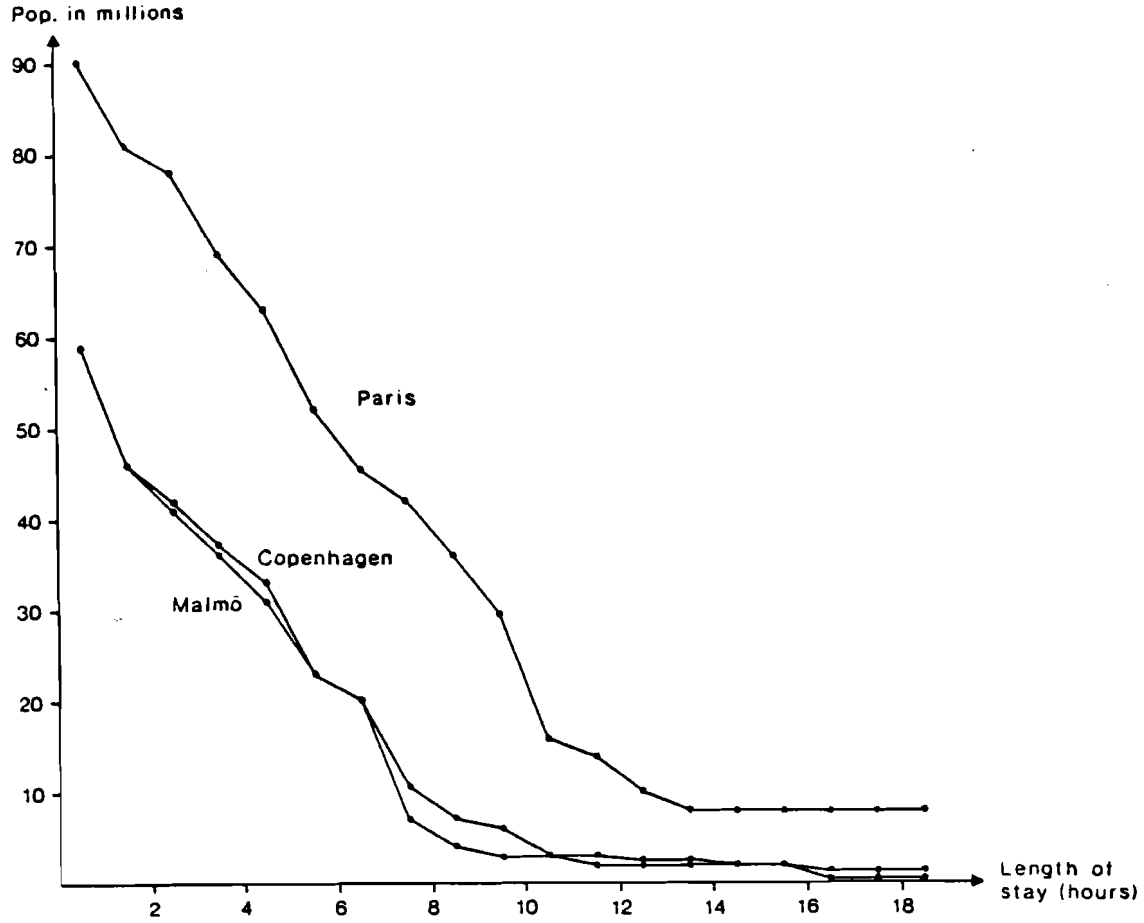

Figure 5. The relationship between the maximum stay time (duration of stay) and the potential number of individuals who can be reached from Paris, Copenhagen and Malmoe during a day visit.

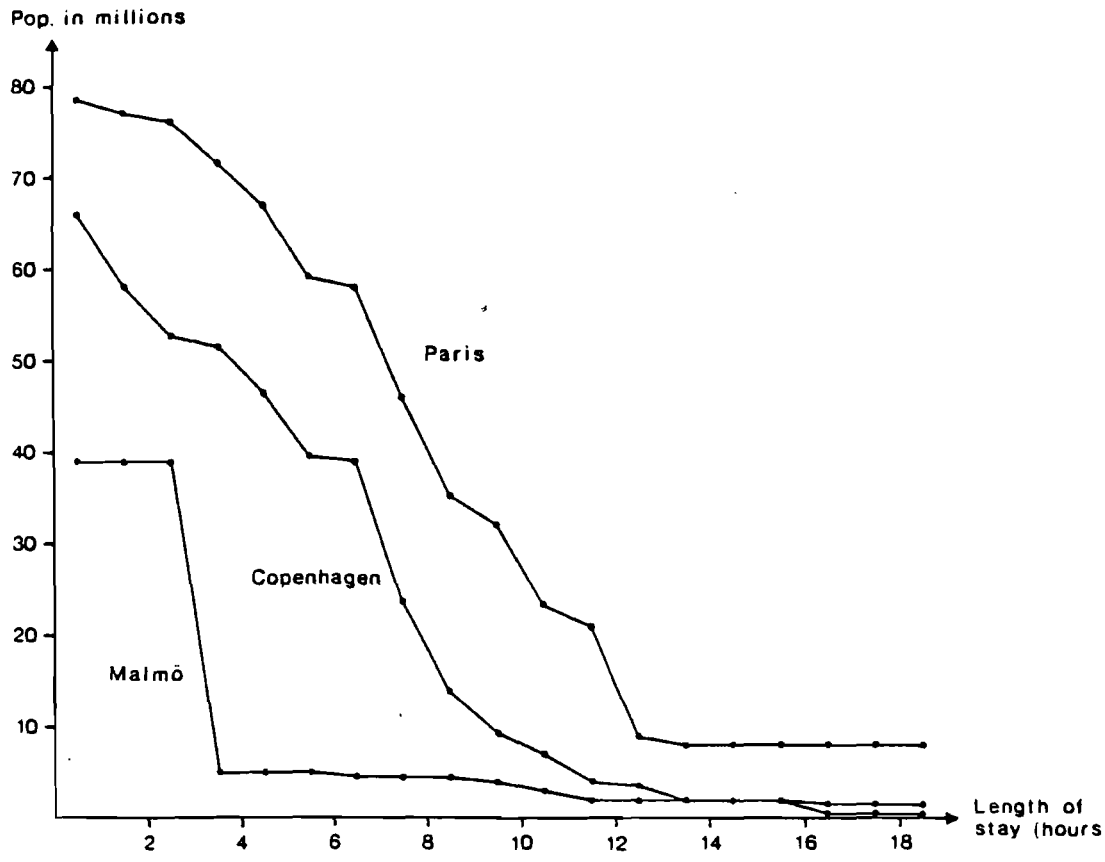

Figure 6. The relationship between the maximum stay time (duration of stay) and the potential number of individuals who can travel to Paris, Copenhagen and Malmoe during a day.

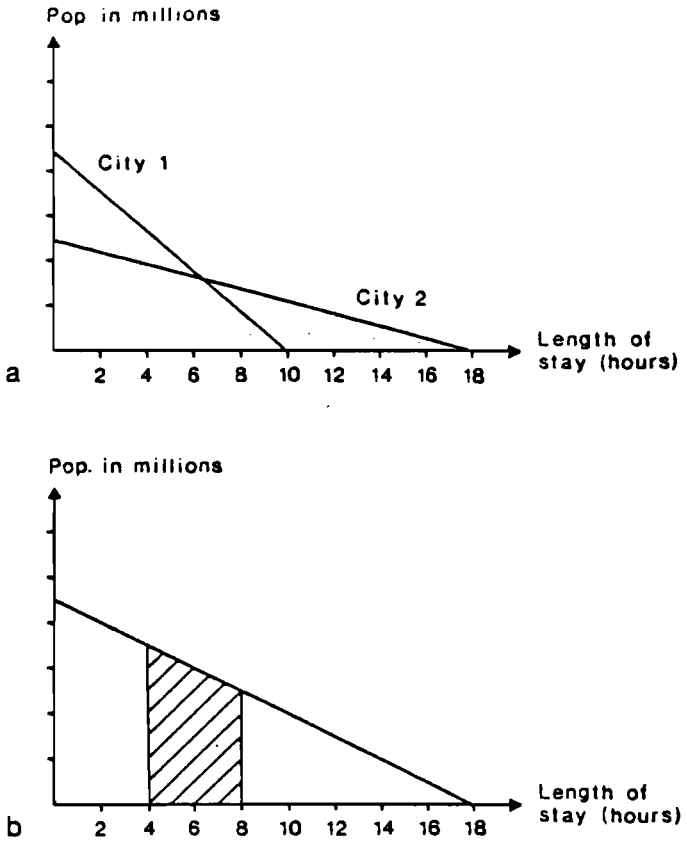

Figure 7. The contact accessibility calculated as the area
(a) below the whole location profile,
(b) between four and eight hours' length of stay.

The urban centres' outbound and inbound contact accessibilities were analysed by various methods using their location profiles, the purpose being to obtain specific measures of contact accessibility. In the first experiment, the area below the profiles for each urban centre was calculated. These areas were intended to measure the outbound and inbound contact accessibility, as the areas below the curves represent the total number of inhabitants that a person living in, or travelling to, a given city could visit during a single day. The results of this measure were not satisfactory as identical computed values could represent totally different location profiles (Figure 7:a). As an alternative to the first method, the following procedure was utilised. The area between four and eight hours' duration of stay for each location profile was calculated (Figure 7:b). This time interval was chosen since it is assumed to be required in order to accomplish a day's work and make a single day trip worthwhile. This procedure of calculating the outbound and inbound contact accessibility is not an ideal solution, but unlike the first measure, these results can be meaningfully interpreted.

The results of the contact accessibility analysis are mapped out in Figures 8 and 9. These figures are called "The European potential contact maps - outbound and inbound accessibility".

4.1 Outbound accessibility

As is clear from Figure 8, there are significant spatial differences with regard to outbound contact potential within Europe. The most favourable zone of outbound accessibility, called the "Primary European Centre", is delimited by lines drawn between Paris-London-Hamburg-Munich-Milan-Lyon-Paris. The only urban centres that have correspondingly high values outside this zone are: West Berlin, Vienna, Rome, Dublin, Birmingham, and Manchester..

The Scandinavian urban centres, the rest of the British Isles, and Southern as well as Western France form three other relatively homogenous outbound contact accessibility blocks. Because of their medial position in terms of outbound accessibility, these three blocks are referred to as the "Intermediate European Centres". The only urban centres having similar values to the "Intermediate European Centres" and falling outside these zones are Madrid and Turin.

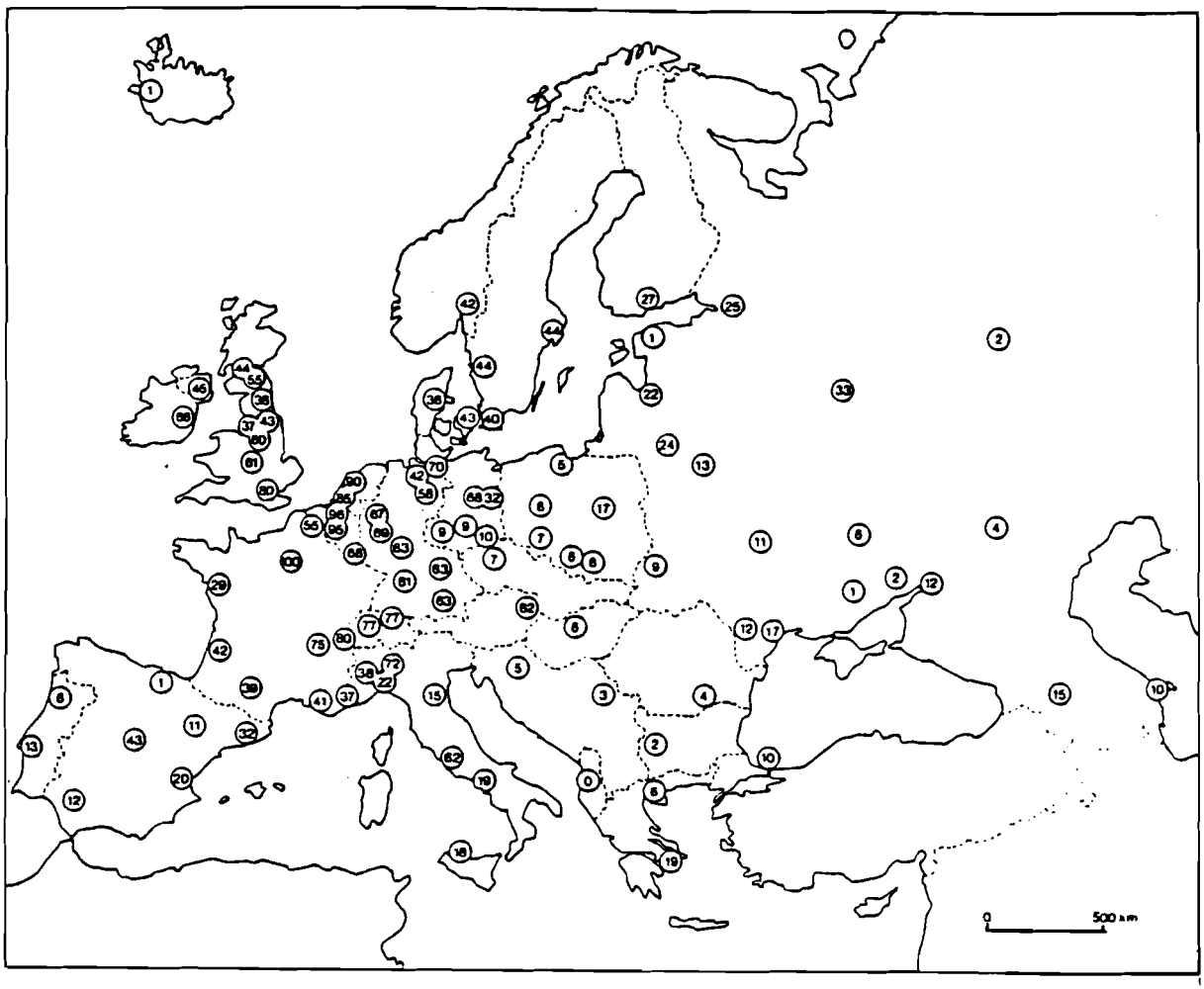

Figure 8. The European potential contact map: outbound accessibility. The values are expressed relative to the most accessible urban centre (Paris = 100).

The rest of the urban centres all have lower contact accessibility and are referred to as the "Secondary European Centres". Within this overall low accessibility zone, Moscow, East Berlin and Barcelona are clearly the most accessible.

4.2 Inbound accessibility

The inbound contact accessibility map (Figure 9) shows that most urban centres belonging to the "Primary European Centre" have the same relatively favourable positions in terms of their inbound contact opportunities. When compared to the outbound contact accessibility map, Copenhagen has a much higher position and is therefore placed within the "Primary European Centre".

A striking change occurs at the intermediate level of inbound accessibility when compared to the European outbound accessibility patterns. Only the British cities can be considered to have an intermediate position. With the above-mentioned exception of Copenhagen, all the other intermediate outbound centres are clearly less accessible regarding their inbound properties, and thus drop into the "Secondary European Centres" category.

4.3 Toward a nodal hierarchy of accessibility

By comparing Figures 8 and 9, it is evident that similar patterns exist between outbound and inbound contact accessibility. The "Primary European Centre" remains identical in terms of contact accessibility in both cases. But important differences clearly exist between outbound and inbound potential. The major change occurs between the "Intermediate European Centres" and the "Secondary European Centres". This is indicated by the marked decrease in the number of cities of the "Intermediate European Centres" inbound category and the increase in the number of cities within the "Secondary European Centres" inbound category. Thus, a significant characteristic of existing European transport is that outbound contact accessibility is clearly better than inbound movements.

Some other properties of the two contact accessibility maps are interesting. The political boundary between Eastern and Western Europe is distinctive and constitutes an important barrier to the development of a truly integrated European contact system. Clearly, Western Europe has higher contact accessibility than Eastern Europe. Additionally, within almost all European countries,

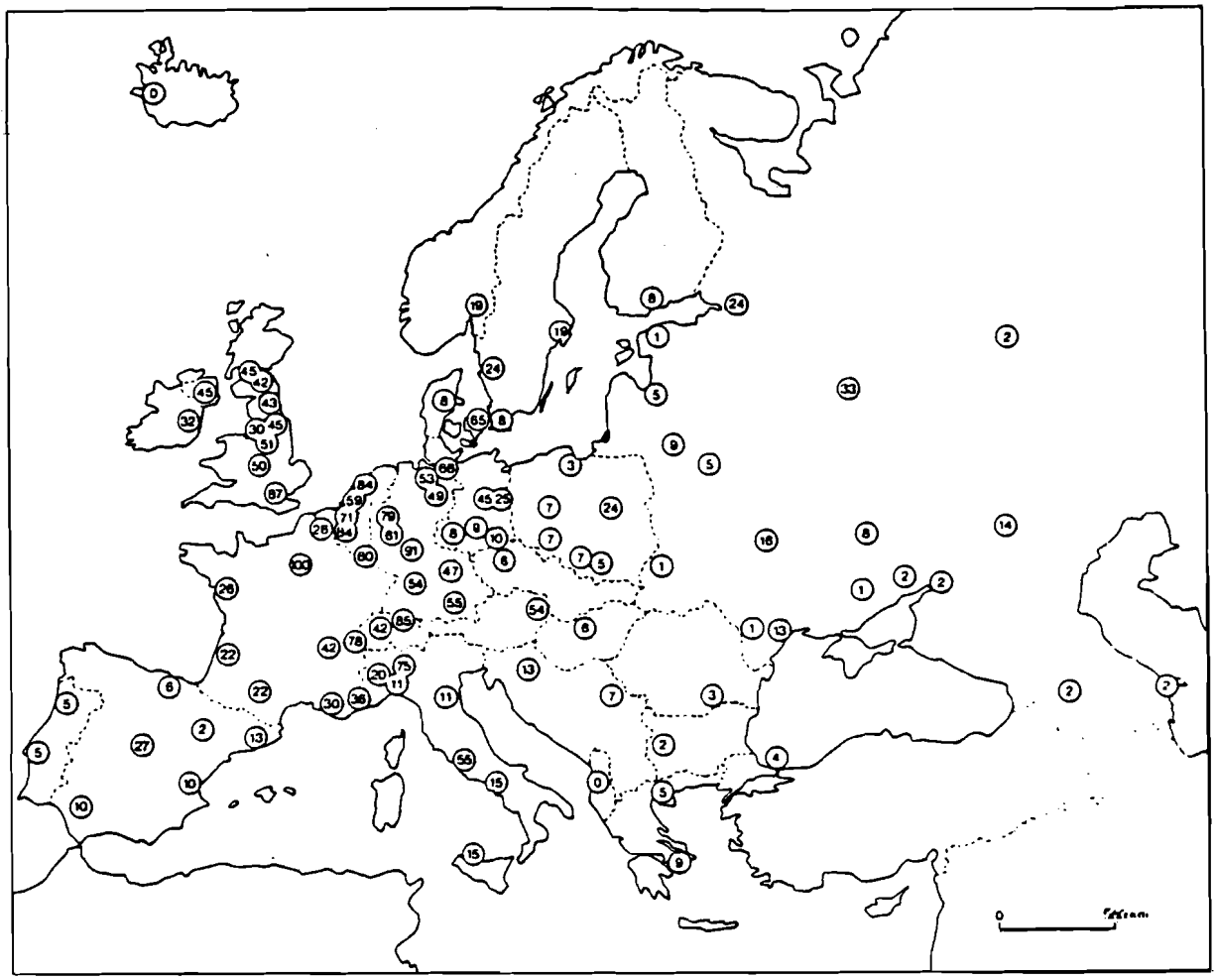

Figure 9. The European potential contact map: inbound accessibility. The values are expressed relative to the most accessible urban centre (Paris = 100).

one or two urban centres have significantly better contact accessibility than others in the country. That is, one or two cities within each country have a favoured position regarding opportunities for face-to-face contacts. This favourable quality must be established at the expense of the remaining urban areas.

A more detailed analysis would reveal at least two different kinds of transport systems within Europe: one international and several national ones. The nodes of the international one, that is the network connecting the different nations in Europe, consist primarily of one or two national centres. From the point of view of accessibility, the cities studied are thus arranged in a hierarchy where national centres have a superior position in relation to the other cities. These other cities are primarily nodes in a domestic transportation system and, therefore, connected to the European network via one or two national centres.

5 PERSONAL CONTACT NETWORKS AND GROWTH CENTRES

The two investigations discussed in the second part of this paper have dealt with the regional balance between the demand and the supply of European travel facilities in 1976. It was found that different nodes in different parts of Europe differ greatly with regard to the possibility of maintaining direct personal contacts.

To judge from a previous study dealing with the development of the European air transport network during 1965-1976, these regional differences appear to have prevailed over a long time. With improvements in technology and the transport network, the ability to maintain direct personal contacts has improved between almost all European urban centres. The major exception is the political division between East and West. But, from the results of the air transport network study, it is clear that accessibility for the cities belonging to the "Primary European Centre" has increased when compared to the less accessible nodes. Thus, the majority of the new air transport possibilities since 1965 have developed between those nodes that already had the highest accessibility values in Europe in 1965.

This trend since 1965 at the international level corresponds to a similar trend at the national level in Sweden. Thus it may be suggested that the contact-intensive employees in Europe have become more and more concentrated in the

most accessible nodes. As no data on the change and the regional distribution of contact-intensive employees in Europe exist, there is no possibility of verification. By studying the development and locations of the headquarters of the biggest national firms and organisations, the multinationals, and the international organisations, someindication of the trend could be obtained.

In future research dealing with accessibility in the European system of cities, the intention is to carry out a series of experiments with operational "models of Europe", similar to those which have been used for Sweden.[4] The primary purpose of these model experiments is to test how different possible developments in European trade policy (e.g. enlarged markets, customs unions, trade agreements) may affect contact possibilities in various parts of Europe, i.e. to develop the European contact accessibility maps of the future. These experiments will be based on three changes which can affect accessibility maps: (1) a change in the need for direct personal contacts in business and government, (2) a change in the regional distribution of contact-intensive employees and (3) a change in the transport network. Which changes are probable depends, of course, very much on the time range chosen for studies of the future. Radical change in the personal contact requirements of various occupations is probably a matter belonging to the fairly distant future. But, as can be seen from the Swedish studies mentioned previously, the regional distribution of employment and the transport system can change comparatively rapidly.

Of course experiments of this kind give rise to a series of both methodological and theoretical problems, which must be solved in order to arrive at an accurate understanding of the European contact potential maps. The biggest problems seem to be those of geographical scale and political division.

The present report has supplied a brief presentation of some investigations which could surely be adapted to, and associated with, other studies in the Analysis of Human Settlement Systems project. It should not be too complicated, for instance, to adapt the studies of contact and travel facilities to the selection of centres, the regional subdivisions, and the statistical data presented in Peter Hall and Dennis Hay's report, Growth Centres in the European Urban System.

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