

The Computer Developed Linguistic Atlas of England

Dialectological editors:
Wolfgang Viereck and Heinrich Ramisch

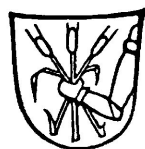
9.6. *Chitsuko Fukushima*
Standardization in England Based on the
Morphological Data of CLAE

Computational production:
Harald Händler and Christian Marx

9.7. *Fumio Inoue and Chitsuko Fukushima*
A Quantitative Approach to English Dialect Distri-
bution: Analyses of CLAE Morphological Data

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With dialectometrical contributions by
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9.7. *Fumio Inoue and Chitsuko Fukushima* A Quantitative Approach to English Dialect Distribution: Analyses of CLAE Morphological Data

9.7.1. The Context of this Study

In this paper the results of the application of a multidimensional method will be presented. Geographical distribution patterns of English dialects will be discussed on the basis of the quantificational analysis of morphological data.

The computational study of dialects is flourishing all over the world. A number of atlases drawn by computer have appeared and several statistical methods have been applied to their data in many parts of the world (Inoue 1995, forthcoming).

Arranging dialect maps according to their distribution patterns is a task in which many dialectologists are interested. But such a procedure is difficult at least in two senses: first, the dialect maps usually include more than two word forms (sometimes even used by the same informant), and second, the geographical distribution pattern is continuous and difficult to divide and classify. In the study of Japanese dialects so far, the application of multivariate analysis has brought successful results to the classification of geographical distribution (Inoue 1988; Sibata and Kumagai 1993). Many kinds of multivariate analysis were applied to one group of Japanese dialectal data concerning their distribution and a comparison of several quantificational methods became possible (Inoue and Kasai 1989). The application of a simplified quantificational method (a kind of gravity centre method) employed after conducting multivariate analysis was also advocated (Inoue 1996a, 1996b and 1996c).

The success of these analyses on Japanese dialects inspired us to apply the same methodology to another language in order to see whether the basic pattern of dialect distribution was similar. The application of the same methodology to different languages will be theoretically productive. Application to other languages would verify the validity of the methodology and would open up a new quantificational field of “interlingual dialectology” or “interlingual dialectometry”.

9.7.2. Methodology

9.7.2.1. Multivariate Analysis: Hayashi 3

The multivariate analysis applied to the CLAE data is “Hayashi’s quantificational theory type 3” (hereafter referred to as “Hayashi 3”) which was developed by a Japanese scholar (Hayashi 1954). This method can be applied to non-numerical (nominal, categorical) data, and can analyse the data just like Factor Analysis. This method is also called “quantification for grouping”, or “a method for gathering similarities” (Hayashi 1954, Inoue 1986), and has been widely applied to public opinion polls in Japan. This method was first applied to sociolinguistic data, and later to several sets of geographical distribution data including glottograms (age-area graphs), and clear distribution patterns appeared as a result. This method is analogous to the correspondence analysis developed by Benzecri in France (Sibata and Kumagai 1993). Nishisato’s dual scaling method which was applied by Cichocki (1993) is also similar in its basic idea.

The greatest merit of Hayashi 3 is that the whole set of linguistic data can be treated directly by computer without recourse to non-linguistic information. It enables us to find innate data patterns.

This technique is thus most appropriate for data such as CLAE, which is basically a matrix of the investigated items (words, word forms) and localities (survey points).

9.7.2.2. Procedure of Analysis

The raw data of CLAE had to be technically converted. It was first converted into an MS-DOS text file which could be processed by Japanese personal computers (NEC PC9800 series).

The CLAE data was then transformed into a matrix of "free-check" reactions of 1/0 data: the answers of each informant were interpreted as either standard (1) or non-standard (0). Only answers consisting of Standard English forms were used in the calculations. The judgement of standard and non-standard was made by Fukushima's SEAL program as described in her paper in this volume.

The data was converted and read into a computer (HITAC M360). A package program PPSS2 (offered by HITAC) for Hayashi's quantificational theory Type 3 was then applied.

As the total number of the morphological items of the CLAE Vol. 1 and Vol. 2 was larger than 100, the items of CLAE 1 (M1-M56 items for Vol. 1) and CLAE 2 (M001-M064 items for Vol. 2) had to be calculated separately. Two series of calculations brought out slightly different results, but the basic structures of the results were considered to be the same. The two series of results will hereafter be shown side by side.

9.7.3. Application of Hayashi 3

9.7.3.1. Direct Results of Hayashi 3: Classification of Items

The results of the application of Hayashi 3 are represented basically by numerical values of more than two axes. The eigenvalues and the normalized scores of the correlation coefficient of the three axes are shown for the two groups of items in Table 1. In the analysis of CLAE, the values of the first two axes were found to be sufficient to explain the basic geographical distribution pattern. As the results of the analysis of the third axis did not show significant patterns, only the values of the first two axes will be utilized in this paper.

Table 1: Eigenvalues and Normalized Scores of Correlation Coefficient

	Vols	Axis 1	Axis 2	Axis 3	Categ.
Eigenvalues	CLAE 1	0.09	0.07	0.05	56
	CLAE 2	0.12	0.04	0.04	62
Normalized Scores of Correl. Coef.	CLAE 1	0.30	0.26	0.22	56
	CLAE 2	0.35	0.21	0.19	62

The direct results of the analysis are the numerical values for each item (standard forms of the word). The results are graphically shown in Figs. 1 and 2 for ease of interpretation.

In Figs. 1 and 2, values of the first axis are shown horizontally, of the second axis, vertically. Comparison of these graphs with the distribution maps made by Fukushima's SEAL program for each item showed that the items on the right-hand side are those standard forms which mainly lie in the northern part of England, and those on the left-hand side, in the southern part.

The items can be classified into several groups according to the objective patterns in Figs. 1 and 2 and according to the authors' subjective judgements of the geographical distribution patterns of the standard forms. A temporary classification of the geographical distribution is shown in Figs. 1 and 2. The classification into 5 groups (A to E) for CLAE 1 items and into 6 groups (A to F) for CLAE 2 items was found successful and will be utilized throughout this paper.

* DISTRIBUTION TABLE *

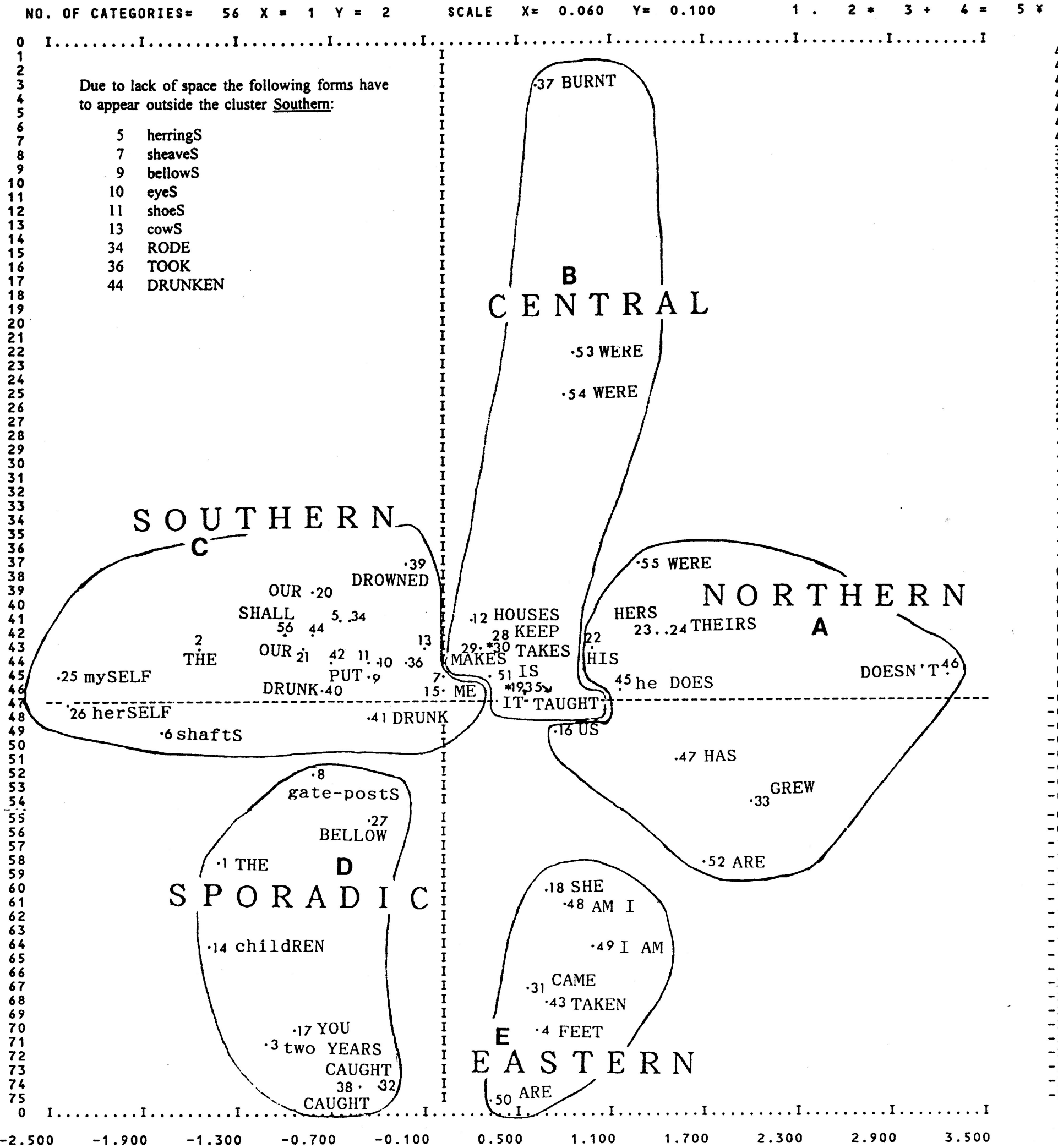
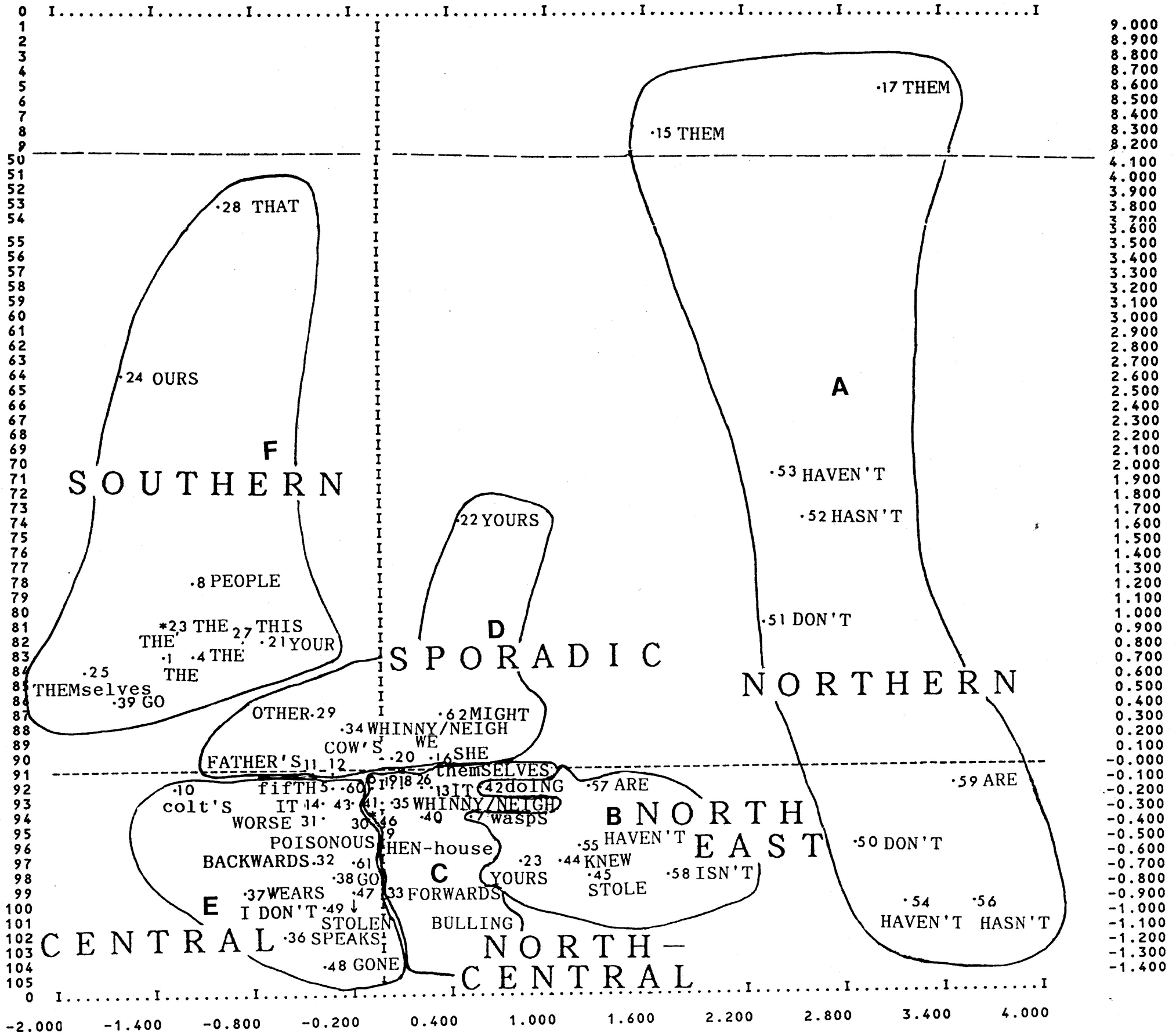


Fig. 1: Values of the 1st and 2nd Axes by Hayashi 3: CLAE 1 Items

* DISTRIBUTION TABLE *

NO. OF CATEGORIES= 62 X = 1 Y = 2 SCALE X= 0.060 Y= 0.100 1 . 2 * 3 + 4 = 5 *



Due to lack of space the following forms have to appear outside the clusters:

Central	North-Central
43 DONE	6 HOOFS
60 I'M NOT	41 STEAL
61 she ISN'T	46 CREPT

Fig. 2: Values of the 1st and 2nd Axes by Hayashi 3: CLAE 2 Items

9.7.3.2. Indirect Results of Hayashi 3: Geographical Distribution

The results of Hayashi 3 can also be shown indirectly by calculating the average values of axes 1 and 2 for the items (standard forms) provided at the 313 localities (survey points). Values are calculated for each locality. Average values for the 41 counties were calculated here because showing values of all 313 localities would have been too complicated. On Figs. 3 and 4 the names of the counties are shown by abbreviations¹, and names showing larger areas are also shown by bold letters. Figs. 1 and 3, and Figs. 2 and 4 correspond with each other; they may be seen as two sides of the same coin.

In Fig. 3 for CLAE 1 items, the first (horizontal) axis corresponds to the distribution pattern from north to south. Cornwall, the southwestern peninsula of England, is separated by the values of the second (vertical) axis and is situated at the top left. London and surrounding areas are situated in the centre, with minus values on the second axis. The second axis seems to correspond roughly to the degree of standardization of morphological features. The overall distribution of the counties in Fig. 3 is very similar to a map of England lying diagonally. The Isle of Man is an exception, being plotted near London, perhaps due to the recent acceptance of standardized English. Fig. 3 shows that the great cleavage of values of axis 1 appears between the northern and the central dialects, with dividing lines lying around the northern edge of the Midlands.

Fig. 4 for CLAE 2 items shows a rather different pattern due to the difference of the morphological phenomena treated. Axis 1 of Fig. 4 is similar to that of Fig. 3 in reflecting the geographical distribution pattern from north to south. A cleavage of values appears again between the North and the Midlands. But axis 2 is unlike Fig. 3. Here Cornwall is not separated by axis 2, London is situated in the centre not corresponding to the geographical location. The Isle of Man is situated at the upper right-hand side between London and the North. Degrees of standardization are not shown by the first and second axes in CLAE 2 items.

The meaning of the second axis of Hayashi 3 is sometimes difficult to interpret from a purely geographical perspective. Comparison with the cumulative maps made by Fukushima (Figs. 5E and 6D, shown later) indicates that in the southern part of England some localities show sporadic high rates of usage of standard forms. This may be because of the recent rapid standardization due to modernization and urbanization. The second axis of Hayashi 3 seems to be related to the rate of standardization.

9.7.4. Cumulative Maps of Distribution Groups

9.7.4.1. Cumulative Mapping Techniques

There are two reasons to make cumulative maps for the respective groups of CLAE 1 and CLAE 2 items. First, comparing each distribution map with the position of items in Figs. 1 and 2 is rather troublesome and time-consuming. Second, arranging all the maps according to the values of Hayashi 3 is possible if we restrict our consideration to the values of the first axis, but there is no space to show all the distribution maps in this order. Thus another technique will be used here in order to compare the results of Hayashi 3 with the actual geographical distribution of the items.

1 The abbreviations of the counties are as follows: Man Isle of Man, Nb Northumberland, Cu Cumberland, Du Durham, We Westmorland, La Lancashire, Y Yorkshire, Ch Cheshire, Db Derbyshire, Nt Nottinghamshire, L Lincolnshire, S Shropshire, St Staffordshire, Lei Leicestershire, R Rutland, He Herefordshire, Wo Worcestershire, Wa Warwickshire, Nth Northamptonshire, Hu Huntingdonshire, C Cambridgeshire, Nf Norfolk, Sf Suffolk, Mon Monmouthshire, Gl Gloucestershire, O Oxfordshire, Bk Buckinghamshire, Bd Bedfordshire, Hrt Hertfordshire, Ess Essex, M Middlesex, So Somerset, W Wiltshire, Brk Berkshire, Sr Surrey, K Kent, Co Cornwall, D Devon, Do Dorset, Ha Hampshire, Sx Sussex.

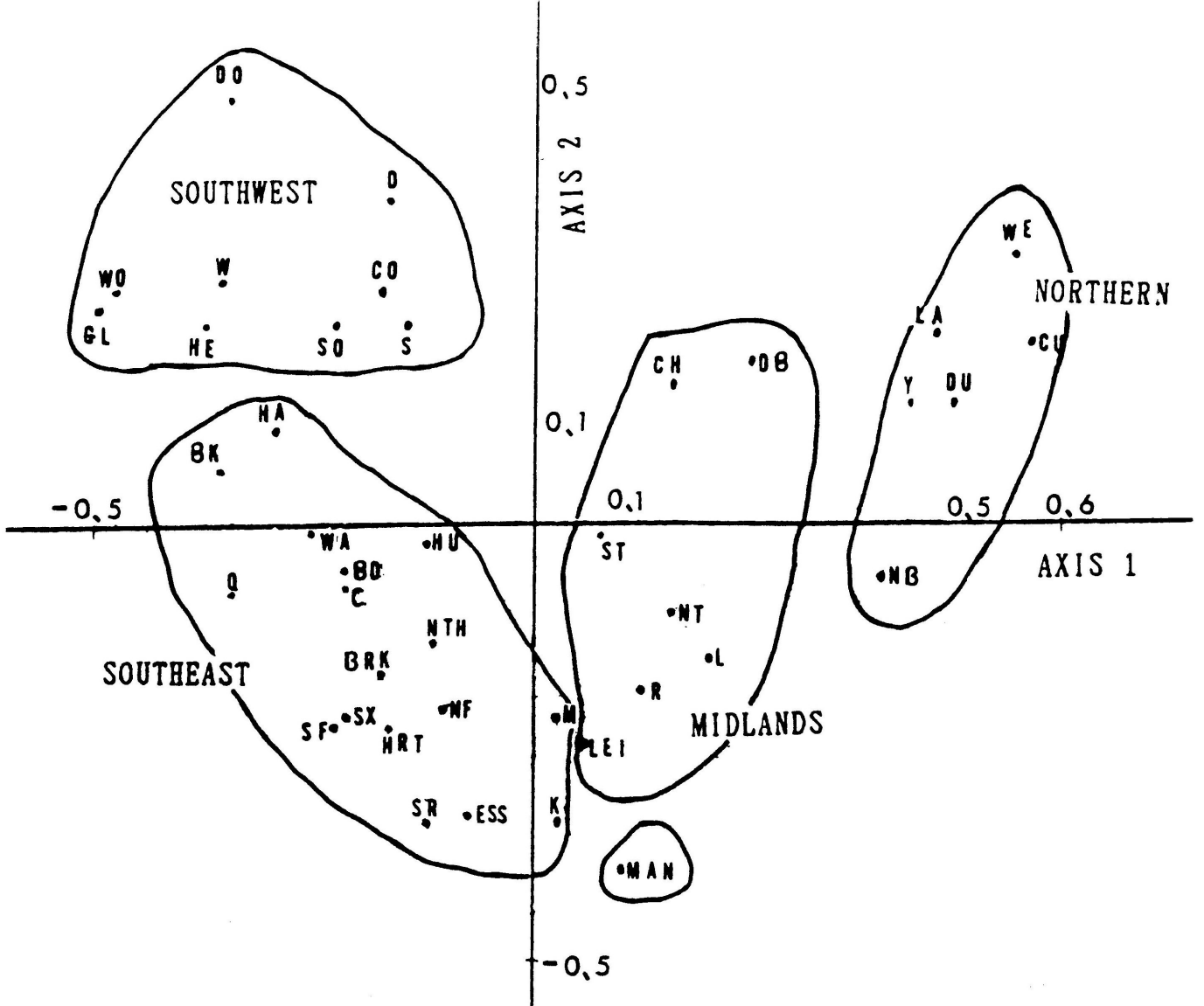


Fig. 3: Average Values for the Counties of England by Hayashi 3: CLAE 1 Items

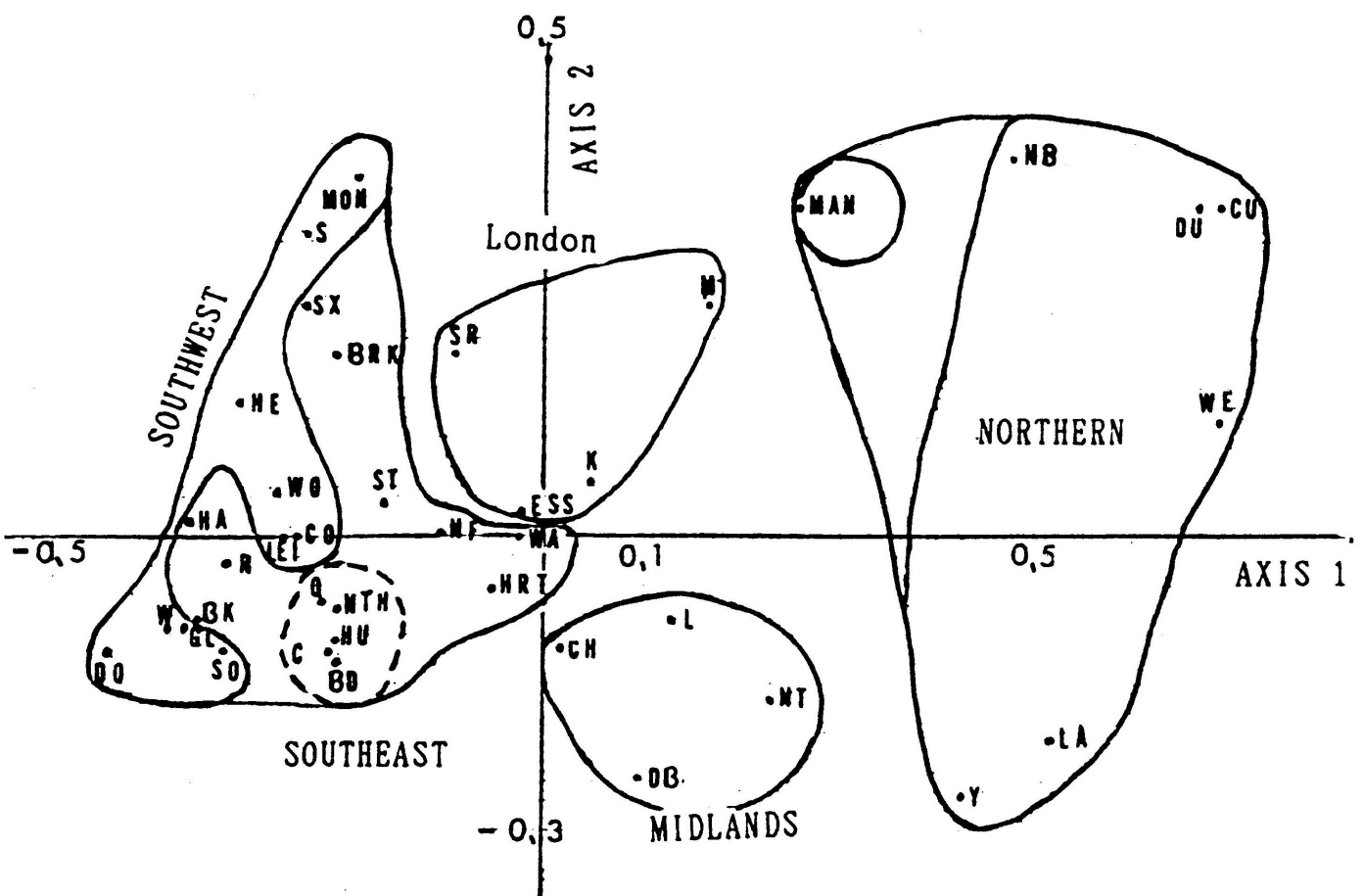
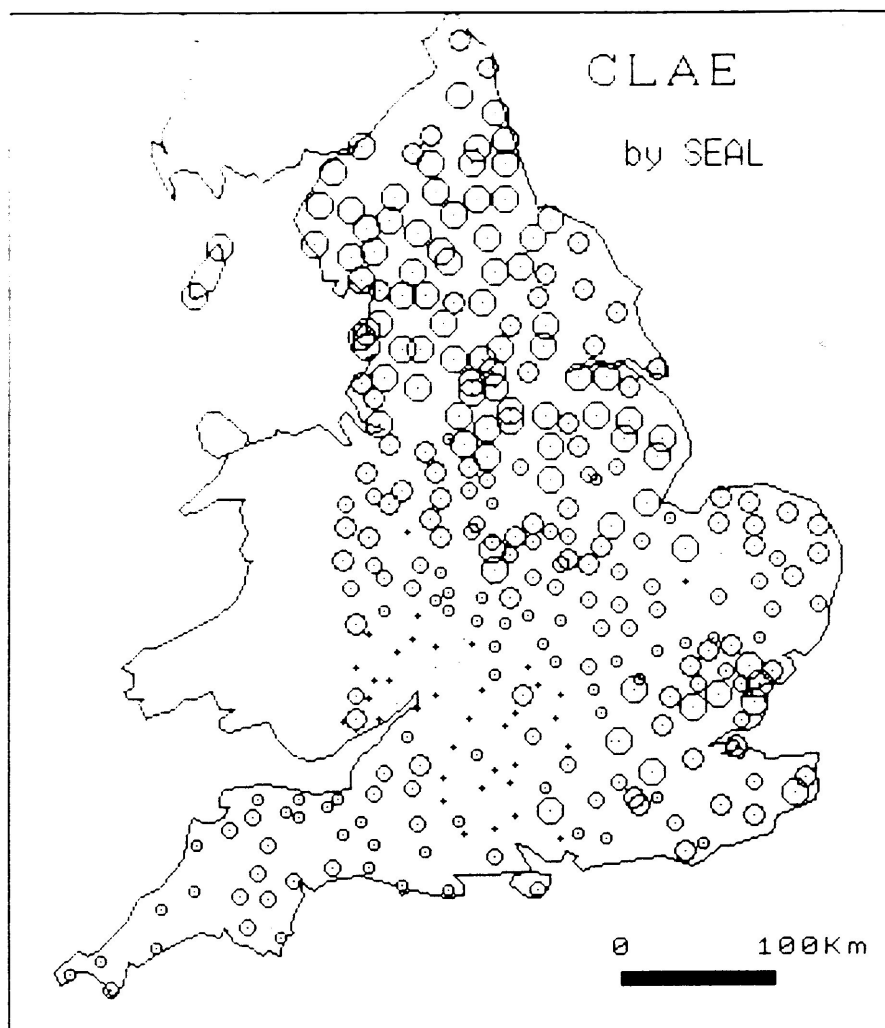
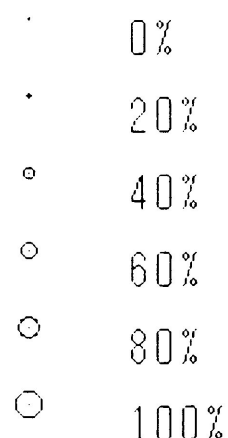


Fig. 4: Average Values for the Counties of England by Hayashi 3: CLAE 2 Items

The items (standard forms of the investigated words) were grouped together into 5 (A to E) or 6 (A to F) groups on the basis of the distribution patterns of Figs. 1 and 2. The number of items provided at each locality were then counted by computer for each of the groups. Then the percentages of use of the item groups for each locality were calculated. These numerical values for the localities were then put into the SEAL program by Fukushima and computerized maps were again produced for the item groups. Figs. 5A to 5E for CLAE 1 items and Figs. 6A to 6F for CLAE 2 items show the results. The number of items given in each



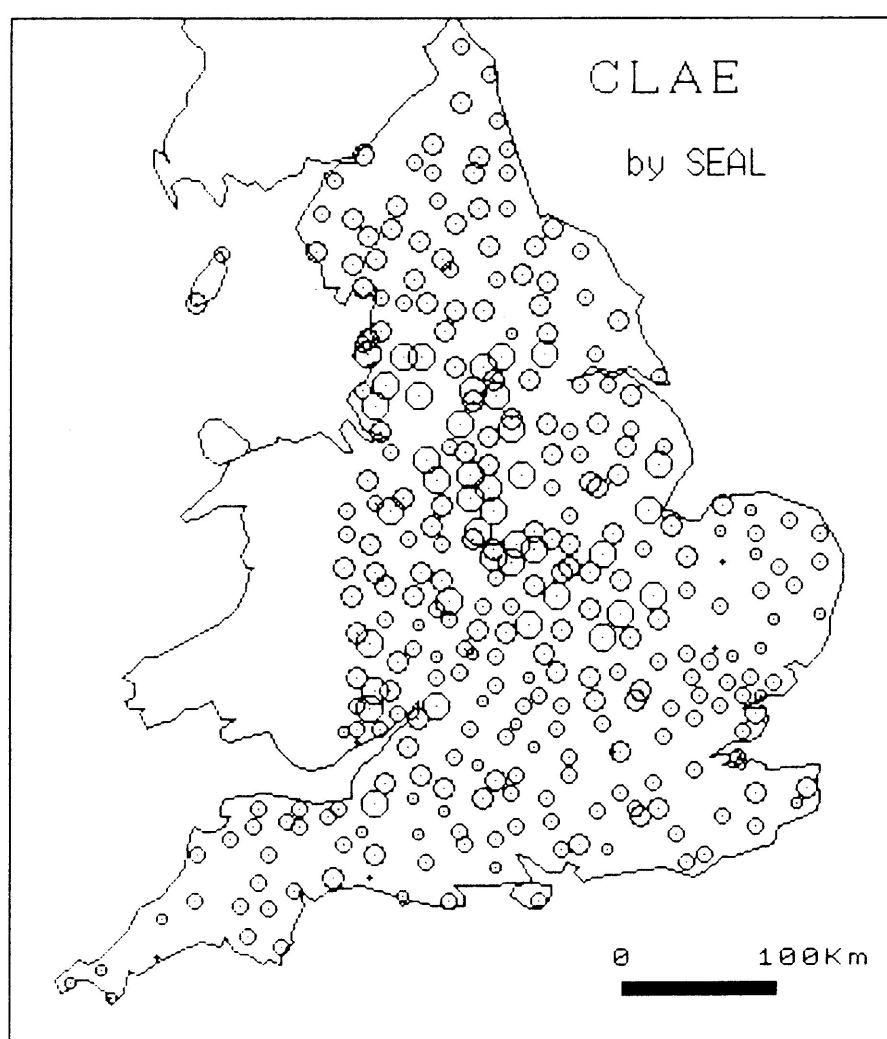
A



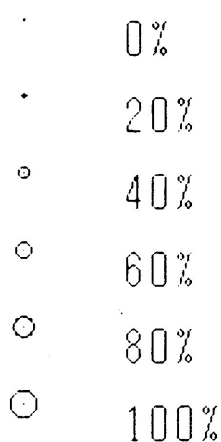
Median= 7
 Mode = 10
 Average= 6.1
 Standard Deviation= 2.9

集計項目数 10

Fig. 5A: Group A of CLAE 1



B



Median= 7
 Mode = 6
 Average= 6.4
 Standard Deviation= 1.7

集計項目数 10

Fig. 5B: Group B of CLAE 1

locality are represented by the size of the circles. Some statistics are also shown as legends of the maps. The results show clear geographical patterns.

Cumulative maps of all the standard forms are shown in Fig. 7 of Fukushima's paper in this volume. Combining the 11 (=5+6) maps in Figs. 5A - 5E and 6A - 6F will reveal a map similar to Fig. 7 of Fukushima's paper. The maps below are different in being divided into groups according to geographical distribution patterns.

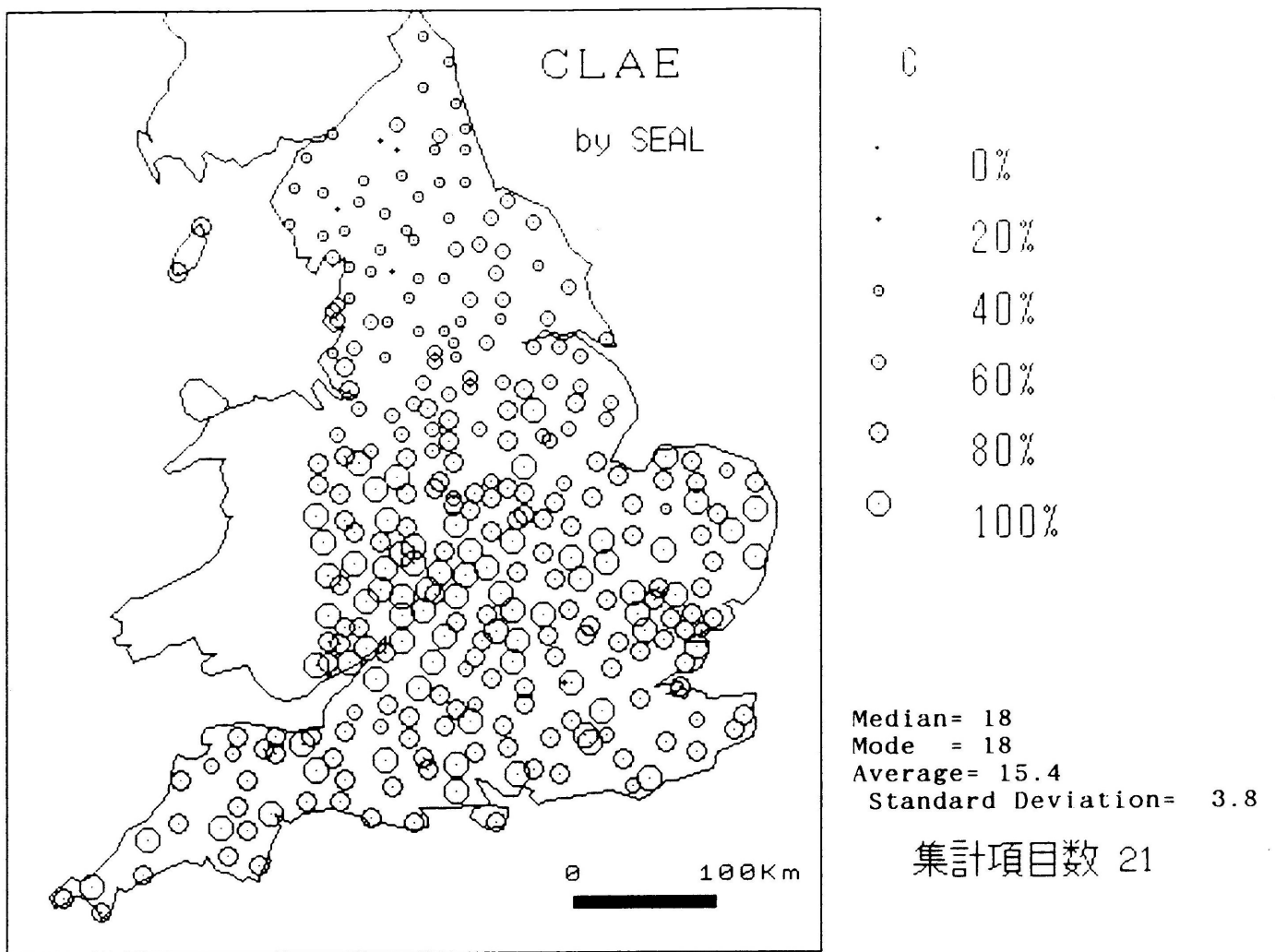


Fig. 5C: Group C of CLAE 1

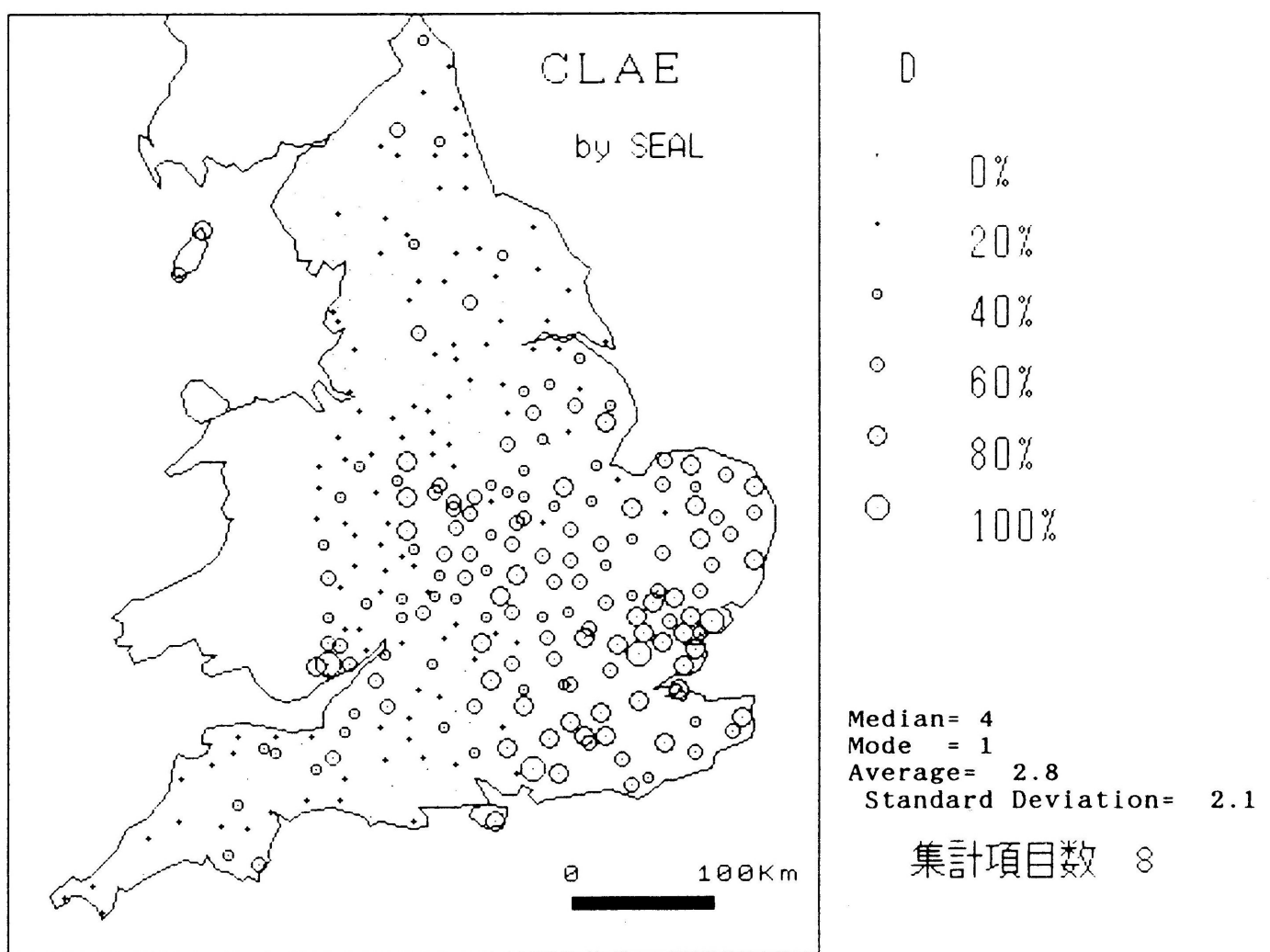


Fig. 5D: Group D of CLAE 1

9.7.4.2. Cumulative Maps for CLAE 1 Items

As will be shown below, similar morphological phenomena appear in the same groups, which means that they reveal similar geographical distribution patterns. Thus the results of Hayashi 3 are both reliable and effective.

The geographical distribution for CLAE 1 items (Figs. 5A to 5E) is discussed below.

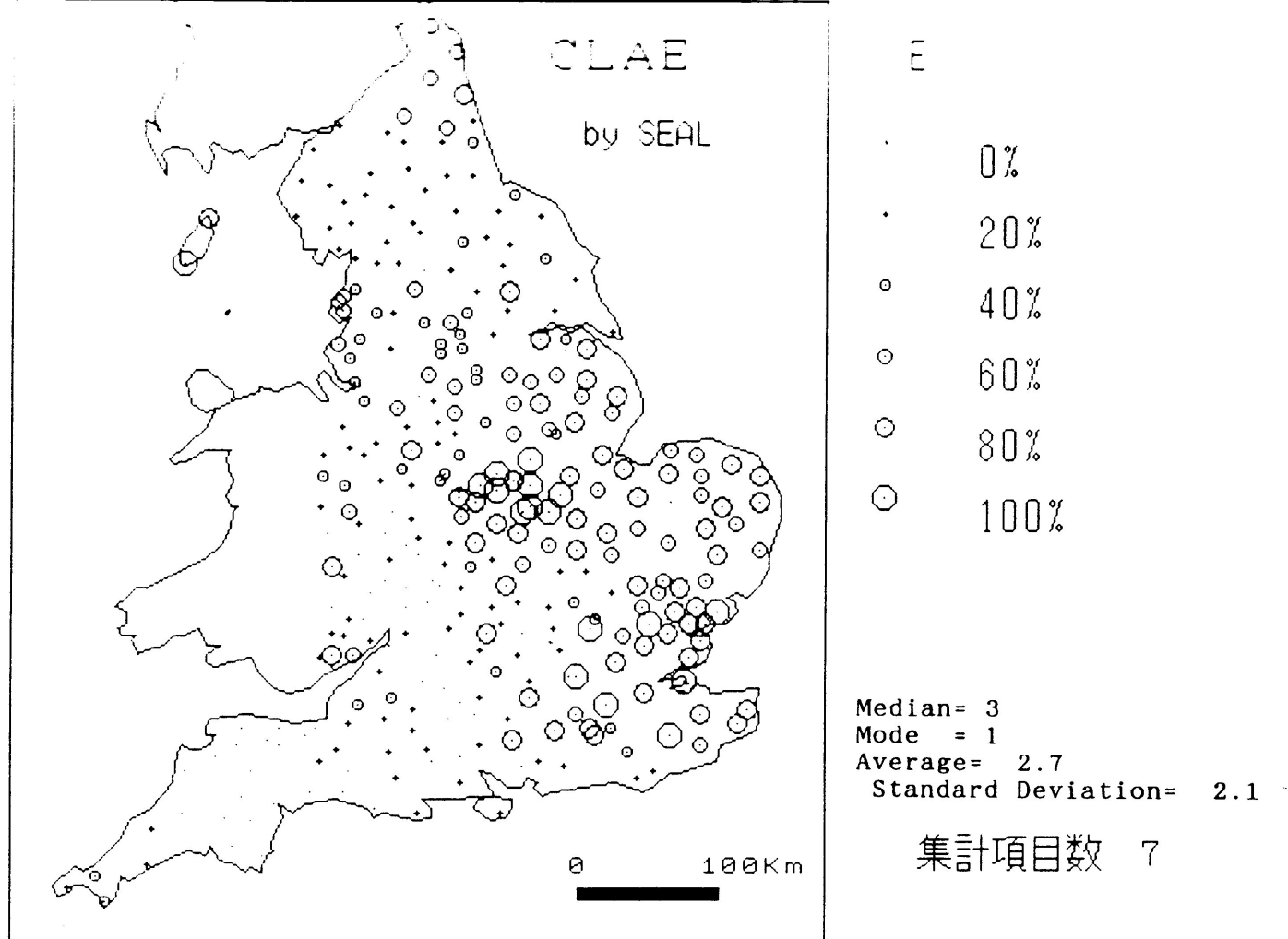


Fig. 5E: Group E of CLAE 1

Fig. 5A is a cumulative map of the following 10 items (the morphological phenomena in question will hereafter be shown in CAPITAL LETTERS): 16 US, 22 HIS, 23 HERS, 24 THEIRS, 33 GREW, 45 he DOES, 46 he DOESN'T, 47 he HAS, 52 they ARE, 55 we WERE.

These are related to basic and frequent morphological alternation of pronouns and verbs. It is quite interesting that according to Fig. 5A these morphological phenomena are distributed mainly in the northern part of England. The southern areas, including the Home Counties around London, show dialectal forms, which are contradictory to lay people's expectations.

Fig. 5B is a cumulative map of the following 10 items: 12 HOUSES, 19 give IT me, 28 KEEP hens, 29 MAKES, 30 TAKES, 35 TAUGHT, 37 BURNT, 51 she IS, 53 I WERE, 54 she WERE.

Fig. 5B shows that these are distributed mainly in the central part of England. Comparison with the distribution maps, however, reveals that some of the items are distributed only in the central area, while others appear throughout most of England.

Fig. 5C is a cumulative map of the following 21 items: 2 THE heat, 5 herringS, 6 shaftS, 7 sheaveS, 9 bellowS, 10 eyeS, 11 shoeS, 13 cowS, 15 with ME, 20 with OUR eyes, 21 OUR own, 25 by mySELF, 26 herSELF, 34 RODE, 36 TOOK, 39 DROWNED, 40 DRUNK, 41 DRUNK, 42 PUT, 44 DRUNKEN, 56 SHALL.

These items are, again, mostly concerned with basic morphological alternations. Fig. 5C shows that these are distributed mainly in the southern half of England.

Fig. 5D is a cumulative map of the following 8 items: 1 in THE oven, 3 two YEARS, 8 gate-postS, 17 YOU are, 27 bulls BELLOW, 14 childREN, 32 CAUGHT, 38 CAUGHT.

Fig. 5D shows that these are distributed mainly in the Home Counties around London, but very sparsely even near London. Some of the corresponding non-standard forms (1 *in t' oven*, 14 *childer*, 17 *thou*) are old-fashioned.

Fig. 5E is a cumulative map of the following 7 items: 4 FEET, 18 SHE is, 31 CAME, 43 TAKEN, 48 AM I, 49 I AM, 50 you ARE. They are distributed basically in the southeastern part of England, mainly near London and around Birmingham. The northern and western areas show dialectal forms. These phenomena seem to be related to modern urbanization.

9.7.4.3. Cumulative Maps for CLAE 2 Items

Below we will discuss the geographical distribution of CLAE 2 items (Figs. 6A to 6F). Notice beforehand that the items in 6B to 6E are very densely distributed in Fig. 2. These items were here subdivided into several groups in order to find minute geographical distribution patterns, although it was difficult to classify these congested variables.

Fig. 6A is a cumulative map of the following 9 items: 015 wash THEM, 017 burglars steal THEM, 050 I DON'T care, 051 they DON'T, 052 he HASN'T, 053 I HAVEN'T, 054 we HAVEN'T, 056 he HASN'T seen it, 059 we ARE.

Fig. 6A shows that these morphological phenomena are distributed mainly in the northern tip of England, the southern area showing non-standard forms. It is quite interesting that the non-standard shortened forms of HAVE and other verbs are widely used in England.

Fig. 6B is a cumulative map of the following 8 items: 007 waspS, 023 YOURS, 042 DOING, 044 I KNEW your voice, 045 STOLE, 055 I HAVEN'T seen it, 057 ARE they married, 058 ISN'T he.

The map shows these to be distributed mainly in the northern and central parts of England. The standard forms such as 055 HAVEN'T, 058 ISN'T are not used in the counties near London. These items should have been classified into the 6A group but their values in Fig. 2 were different.

Fig. 6C is a cumulative map of the following 9 items: 009 HENhouse, 013 to weigh IT, 018 are THEY, 019 isn't HE, 026 themSELVES, 033 FORWARDS, 035 WHINNY/NEIGH, 041 BULLING (on heat), 040 burglars STEAL them.

Fig. 6C shows that these are distributed almost all over England, with the southwestern and eastern tips being exceptions. But comparisons with the distribution maps show that there are two extremes. The items of one type, such as 033 FORWARDS, 041 BULLING are sparsely distributed. The items of the other type, such as 013 to weigh IT, 018 are THEY, 019 isn't HE are densely distributed almost all over England except Cornwall. The latter are standard forms which have been propagated almost nationwide.

Fig. 6D is a cumulative map of the following 8 items: 011 FATHER'S boots, 012 COW'S legs, 016 SHE wears the breeches, 020 WE are, 022 YOURS, 029 the OTHER, 034 WHINNY/NEIGH, 062 MIGHT.

In Fig. 6D the Isle of Man and the urbanized areas in central England show higher values. Some of the items of this group are distributed sparsely and sporadically throughout England. A comparison with each map reveals that these items are 022 YOURS, 029 the OTHER, which were given higher values on axis 2. These standard forms may recently have been spreading in the process of urbanization.

Fig. 6E is a cumulative map of the following 17 items: 005 fifTH, 006 HOOFS, 010 colt'S foot, 014 tasted IT, 030 POISONOUS, 031 WORSE, 032 BACKWARDS, 036 SPEAKS, 037 she WEARS the breeches, 038 they GO to church, 043 DONE, 046 CREPT, 047 STOLEN, 048 GONE, 049 I DON'T know, 060 I'M NOT, 061 she ISN'T.

Fig. 6E shows that these forms are distributed in the central and southeastern parts of England, mainly around London, and around Birmingham. A comparison with the maps shows that the non-use of the standard forms in the northern and western areas is conspicuous, with the exception of 010 COLT'S, 014 IT, 031 WORSE, 037 WEARS, 038 GO and 048 GONE.

Fig. 6F is a cumulative map of the following 11 items: 001 to THE ground, 002 to lay THE table, 003 to THE quick, 004 she wears THE breeches, 008 PEOPLE, 021 I knew YOUR voice, 024 OURS, 025 THEMselves, 027 THIS, 028 THAT over there, 039 they must GO to school.

Fig. 6F shows that these are distributed mainly in the southern half of England, the northern area showing dialectal forms. Among the eleven cumulative maps this map shows the clearest contrast between the north and south of England. A comparison with each map reveals that similar distribution patterns of 001 THE, 002 THE, 003 THE, 004 THE and 021 YOUR contribute much to this effect.

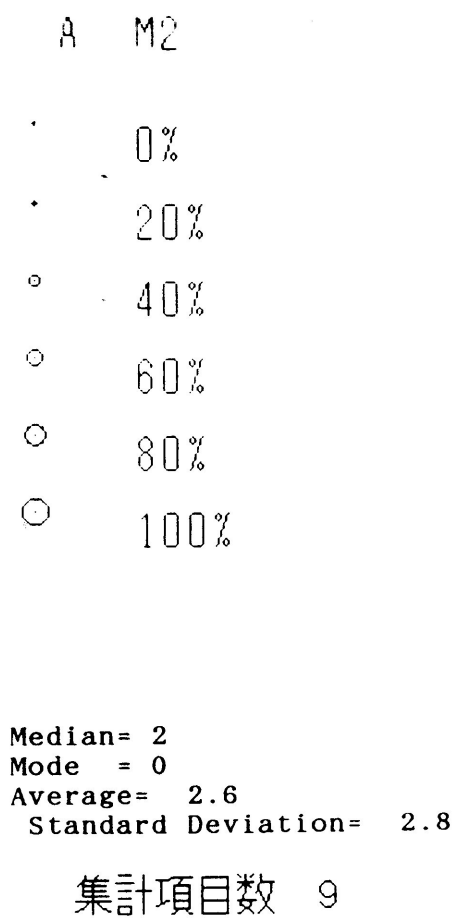
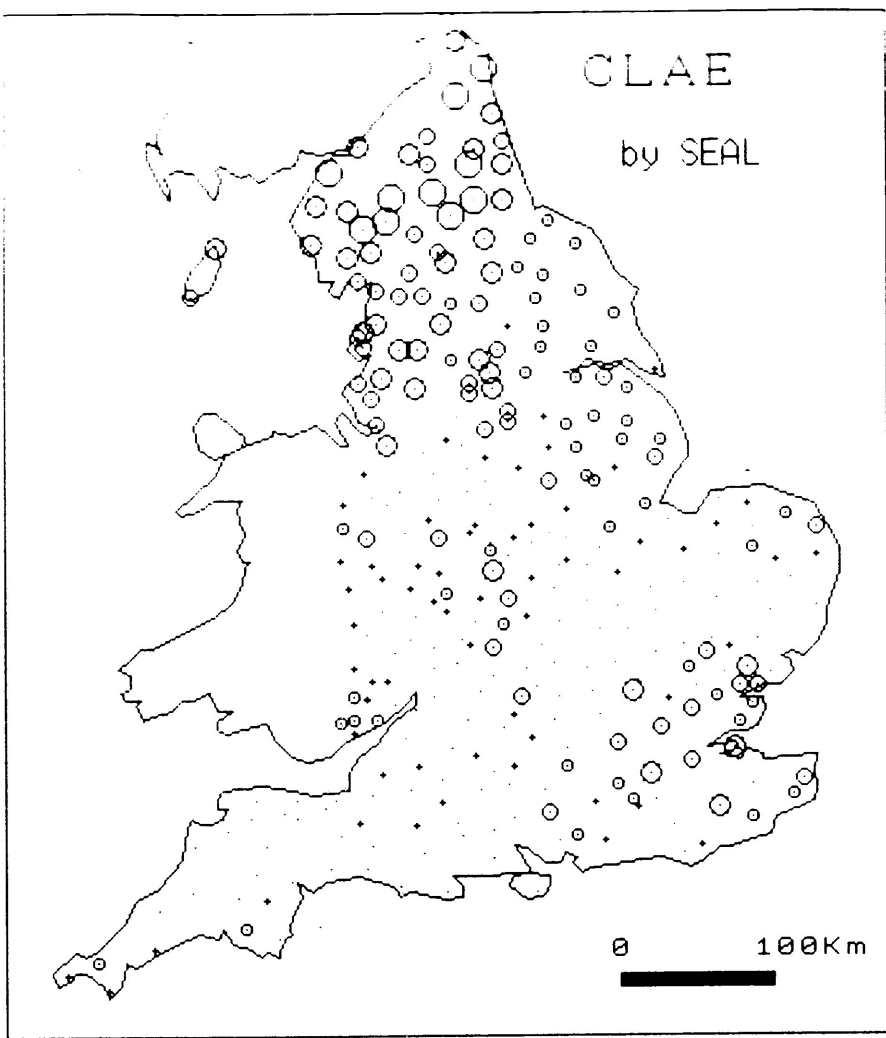


Fig. 6A: Group A of CLAE 2

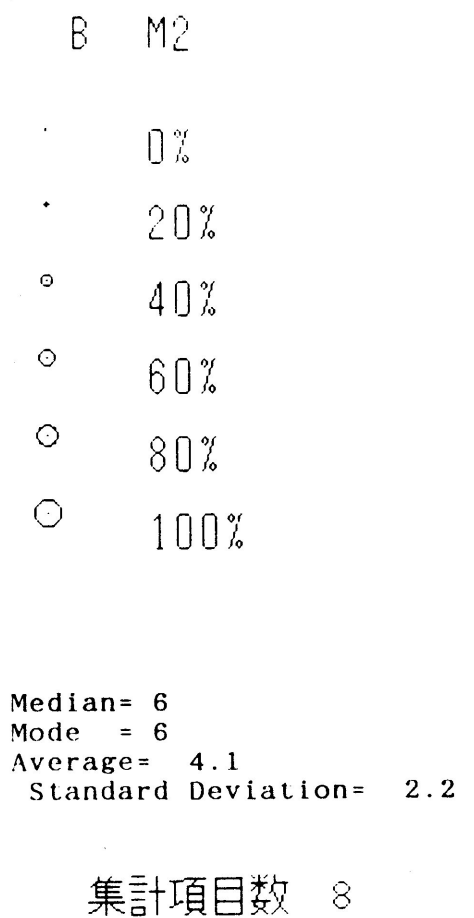
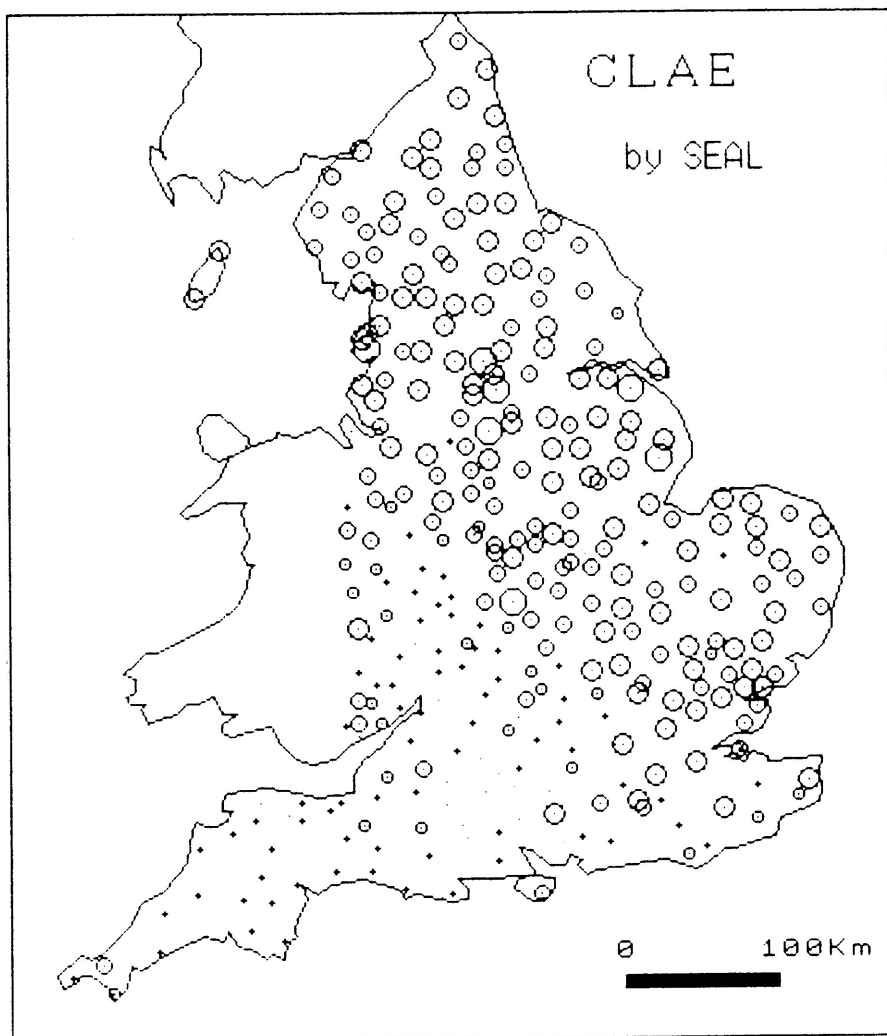
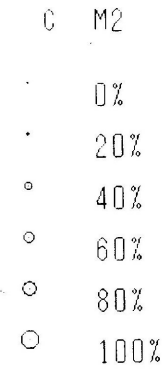
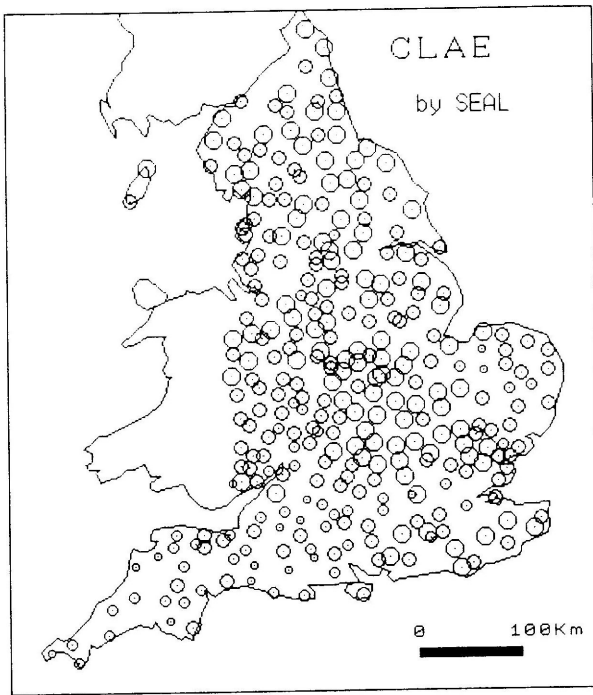


Fig. 6B: Group B of CLAE 2

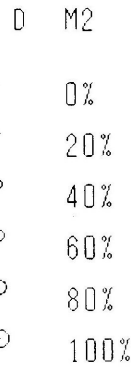
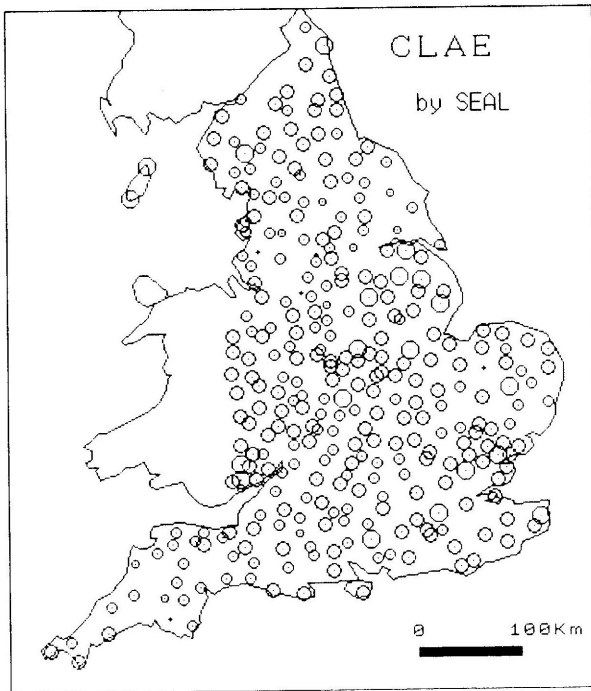
All in all, the grouping of items by Hayashi 3 was productive. As for CLAE 2 items, internal variation within the groups was found, and some of the items should have been classified into adjacent groups. This was especially conspicuous in groups B, C, D and E. As has been pointed out, items in these groups are densely distributed around the centre in Fig. 2. They could have been grouped together from the pattern in Fig. 2 alone, but the subdivision sometimes revealed minute geographical distribution patterns in England.



Median= 9
Mode = 9
Average= 7.6
Standard Deviation= 1.5

集計項目数 9

Fig. 6C: Group C of CLAE 2



Median= 7
Mode = 6
Average= 5.7
Standard Deviation= 1.3

集計項目数 8

Fig. 6D: Group D of CLAE 2

9.7.5. An Attempt at Dialect Division on the Basis of Hayashi 3

An attempt at a geographical division of dialects is possible making use of the maps in Figs. 5A to 6F, or on the basis of county divisions in Figs. 3 and 4. The result is shown in Fig. 7.

The most conspicuous impression from the maps above is the contrast between the north and south. The dividing line can be drawn on the basis of Figs. 3 and

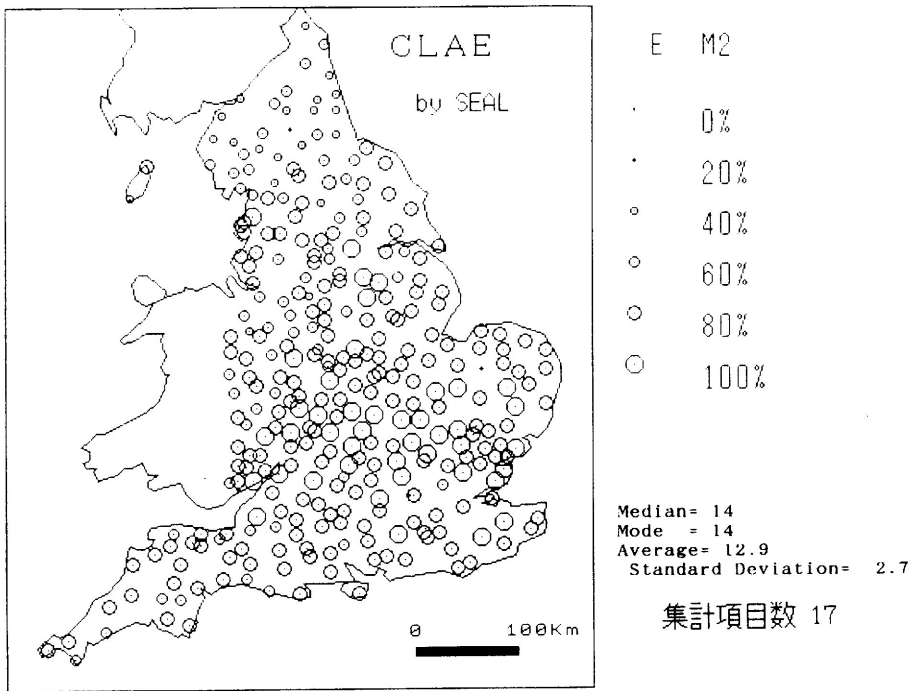


Fig. 6E: Group E of CLAE 2

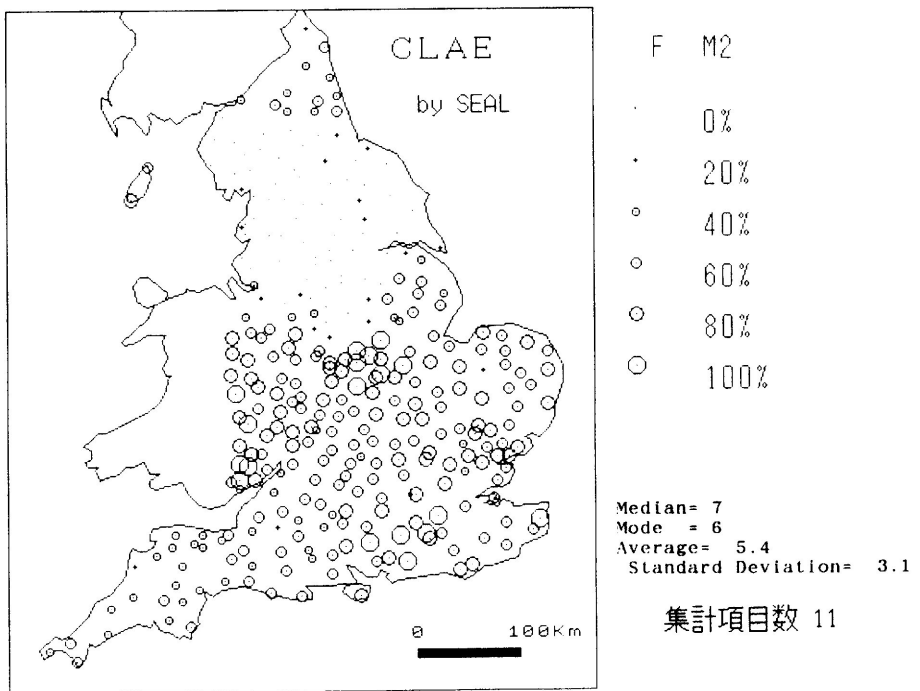


Fig. 6F: Group F of CLAE 2

4. The division of the Midlands and the South is also important, but the line is difficult to draw because of the difference between CLAE 1 and CLAE 2 items. The next important dialectal difference is the southwestern part of England. This dialect division can be further compared with a division on the basis of dialect images of England (Inoue 1995 and 1996c).

Thus the results of Hayashi 3 can be utilized to classify dialects.

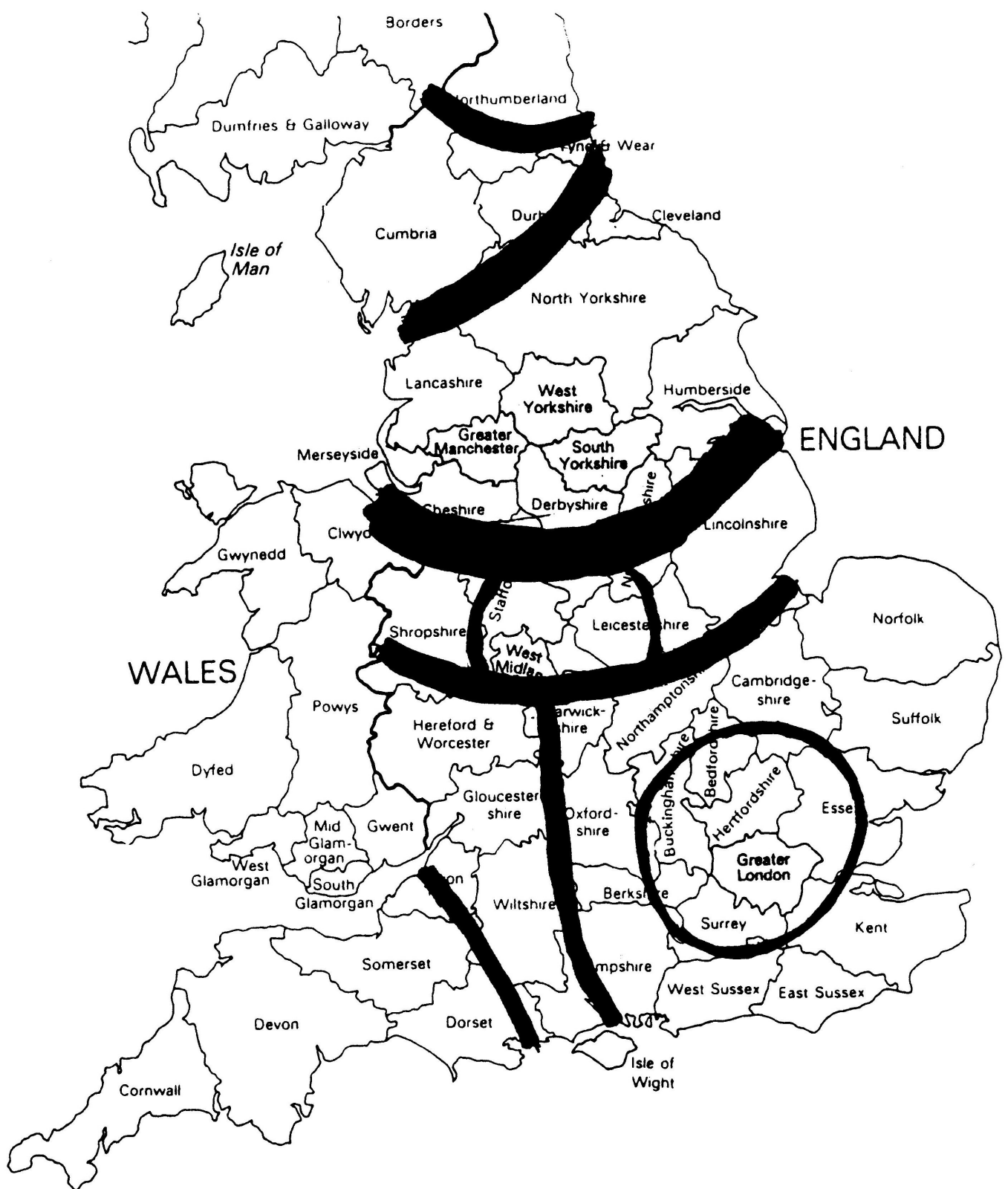


Fig. 7: Dialect Division on the Basis of CLAE 1 and CLAE 2 Items

9.7.6. Comparison between Japanese and English Dialect Distribution

9.7.6.1. Patterns of Diffusion

The merit of Hayashi 3 is that it can show the linguistic similarities which are often found in separate remote areas. These are sometimes older forms in relic areas and sometimes newer forms showing sporadic dissemination. Recent standardization of language in urbanized areas around Birmingham and in the Isle of Man has been clearly shown by Hayashi 3.

The basic distribution pattern of English dialects seems to be the axis of north to south. The northern areas show generally fewer standard forms, though more standard forms are used in some items. The southern regions in general show more standard forms. London and the Home Counties are the central or the focal area for the standard forms. The southwest of England makes the pattern a little more complicated.

In the analysis of Japanese standard forms by using several quantificational methods, the most prominent tendency is that the centre of diffusion of the Japanese standard forms is found in two locations: one, the old capital Kyoto, and the other, the modern capital Tokyo. The standard forms themselves are also classified into two major groups: older forms disseminating from Kyoto and a small number of newer forms disseminating from Tokyo.

In contrast, most of the English standard forms seem to have disseminated from the London area. One exception to this is that in some items northern areas show the distribution of standard forms, with non-standard forms being distributed throughout most areas of England (see Figs. 5A and 6A). However, the standard forms used in the northern tip of England are not spreading from there; northern England is not a focal area but a relic area of older forms.

Thus, although superficial differences are found between Japan and England, the basic mechanism seems to be the same. The mechanism of the dissemination of the standard forms can be explained by two kinds of sources:

- (1) geographical diffusion from the centre of the standard language, which is also a cultural centre,
- (2) social diffusion to urbanized or later acquired territory (the Isle of Man for English, Hokkaido for Japanese).

9.7.6.2. Simplified Representation by Gravity Centre Method

The geographical distribution of the standard (and dialectal) forms can be represented by calculating gravity centres, as has been attempted by Viereck (1992) and Inoue (1984). In a lecture given at the International Congress of Dialectologists and Geolinguists in Budapest in 1993, Inoue advocated a more simplified way of showing dialect distribution patterns by way of the gravity centre method where the areas under investigation are shown as one line (as one dimension) and the gravity centres are plotted on the line (Inoue 1996a and 1996b).

The results of a multivariate analysis of Japanese dialects show that Japan can be represented as a line lying west to east. As for England, the results of Hayashi 3 show that it can also be represented as a line in the north - south dimension. If we want to show the difference of the Southwest more faithfully, England may be represented as a diagonal line from southwest to northeast. The distribution patterns would be shown graphically like an island seen from the sea.

Once multivariate analysis is applied to a set of data, simplified patterns appear. Geographical distribution patterns can be explained more easily if the results of multivariate analysis are utilized.

9.7.6.3. Tasks in the Future

Once computerized, various treatments of dialect data become possible. A comparison of the multivariate analysis of English dialects with other languages will yield interesting results. To include Hawaiian Japanese, for example, into a quantitative treatment of Japanese dialects was rewarding.

One would feel inclined to add other varieties of English in Great Britain to the CLAE data. Including all varieties of English world-wide would be more inter-

esting still. The large size of the data is no problem for computers. Multivariate analysis is effective because it allows us to consider all possible information.

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