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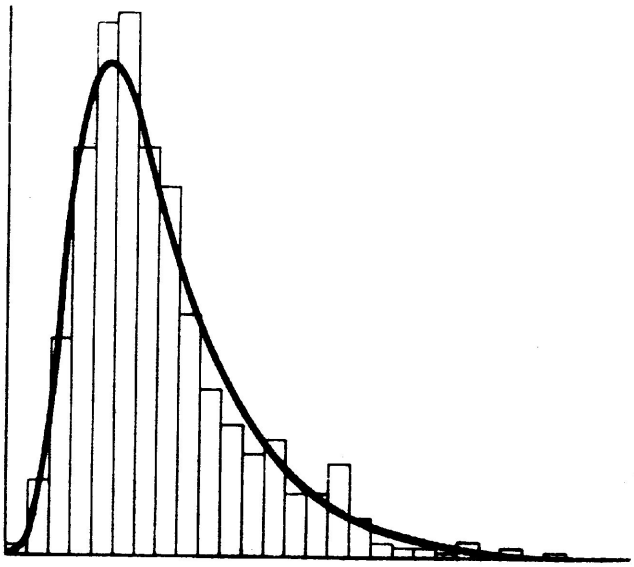
Japanese Quantitative Linguistics

edited
by
Shizuo Mizutani



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謹呈

水谷

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Contents

DIALECT CLASSIFICATION BY STANDARD JAPANESE FORMS

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1. Data and Correlation Matrix

Various methods are now being applied to dialect classification. Quantificational attempts by classification of distribution patterns or by adding-up of isoglosses have recently become popular. In this paper results of two multi-dimensional analyses by means of computer on the basis of distributional data of standard Japanese forms are examined. This is a step towards dialect classification based on standard and basic vocabulary.

The original data is based on 82 selected maps from the "Linguistic Atlas of Japan" (LAJ), in the form of a matrix showing the percentage of standard Japanese forms (ratio to the number of investigated settlements) as columns, calculated for all prefectures (rows) in Japan. A part of the matrix of selected prefectures and selected words is shown in Table 1.

Table 1. Sample matrix of raw data

LAJ NO.	Standard forms	Ratio of average usage of standard Japanese forms								
		HOKKAIDO	AOMORI	...	TOKYO	...	KYOTO	HYOGO	...	OKINAWA
30,31	MABUSII	28.9	6.8	...	88.9	...	11.1	11.3	...	0.0
36	KOGEKUSAI	95.2	58.1	...	100.0	...	97.2	87.3	...	0.0
181	NASU	15.4	0.0	...	100.0	...	18.8	18.2	...	0.0
254	TSUYU	39.8	0.0	...	22.2	...	100.0	98.6	...	0.0
...	....	...	...	...	...	...	...	...	...	...

Similarities between prefectures as to percentages of standard Japanese forms can be shown more clearly by correlation coefficients, which are calculated on the basis of the data above. Table 2 shows the correlation coefficients between prefectures (also showing the average percent of all the 82 standard Japanese forms in the left-most column).

For simplicity's sake third decimal places are rounded and zeros of the units digit are not shown. Thus, 0.38 is shown as 38, and -0.57 as -57. Also, figures with a correlation coefficient greater than 0.5 are written in boldface.

Table 2. Correlation coefficients between prefectures

		Ratio of average usage of standard Japanese																							
	HOKKAIDO	538	HOKKAIDO																						
T	AOMORI	221	55	AOMORI																					
O	IWATE	262	48	65	IWATE																				
H	MIYAGI	310	50	44	76	MIYAGI																			
O	AKITA	212	33	72	66	47	AKITA																		
K	YAMAGATA	275	53	75	77	69	69	YAMAGATA																	
U	--FUKUSHIMA	413	56	53	68	69	46	72	FUKUSHIMA																
	IABRAKI	484	41	21	56	48	28	44	69	IBARAKI															
K	TOCHIGI	607	40	31	39	35	18	36	71	68	TOCHIGI														
A	GUNMA	570	48	49	45	41	32	43	67	52	83	GUNMA													
N	SAITAMA	608	34	39	39	30	24	36	62	60	85	86	SAITAMA												
T	CHIBA	525	28	32	37	31	39	42	57	66	63	56	67	CHIBA											
O	TOKYO	616	36	34	24	24	17	29	54	53	72	68	84	62	TOKYO										
	TOKY ISLANDS	326	27	35	30	13	36	28	46	45	60	57	65	71	67	TKY ISLADS									
	----KANAGAWA	524	36	37	28	30	26	39	56	53	64	62	73	76	80	64	KANAGAWA								
	NIIGATA	360	63	50	54	52	35	62	70	53	47	57	50	46	45	32	68	NIIGATA							
C	TOYAMA	311	52	24	18	19	13	26	26	28	18	22	21	15	18	02	19	55	TOYAMA						
Y	ISHIKAWA	317	54	20	14	17	08	24	26	27	14	17	18	13	20	05	23	51	93	ISHIKAWA					
U	FUKUI	467	51	15	12	14	04	19	18	26	10	10	06	11	05	-00	12	37	72	80	FUKUI				
B	YAMANASHI	534	46	46	38	39	32	49	64	48	68	74	68	60	62	56	71	59	35	33	19	YAMANASHI			
U	NAGANO	557	61	51	47	49	34	55	68	50	64	76	64	51	56	41	66	78	44	39	23	81	NAGANO		
	GIFU	432	59	24	21	11	07	25	35	38	27	31	26	20	23	07	26	64	79	79	71	38	49	GIFU	
	SHIZUOKA	526	56	42	33	22	31	41	58	54	61	64	62	63	61	60	75	73	45	45	36	76	76	59	SHIZUOKA
	-------AICHI	475	63	30	27	21	22	31	46	52	40	46	39	45	40	30	47	69	59	59	50	53	65	79	76
K	MIE	406	58	15	16	15	-02	19	25	29	17	15	11	16	18	12	23	46	61	69	73	32	37	75	49
I	SHIGA	447	50	14	10	12	04	14	11	11	-02	-04	-06	01	00	-07	06	32	57	68	82	12	16	61	28
N	KYOTO	473	54	10	13	21	09	15	14	12	-06	-07	-13	03	-02	-07	05	31	51	61	72	11	15	56	27
K	OSAKA	409	41	07	05	11	03	04	06	07	01	-06	-07	03	07	-01	01	15	43	53	66	10	08	44	19
I	HYOGO	417	42	06	12	16	07	08	11	10	-07	-12	-15	-01	-03	-06	-00	23	51	60	71	05	08	54	22
	NARA	378	34	03	01	05	03	-03	02	03	-10	-13	-13	-00	-02	-07	-03	18	47	52	63	07	02	51	20
	----WAKAYAMA	436	36	-01	07	02	00	-06	09	24	08	03	05	14	09	06	08	25	55	60	69	12	13	58	32
C	TOTTORI	381	53	36	23	24	16	29	38	21	16	14	09	11	11	07	13	49	50	50	55	19	27	52	37
Y	SHIMANE	350	61	28	27	27	15	29	42	35	17	14	11	17	10	14	18	47	52	53	54	19	29	53	40
G	OKAYAMA	417	38	12	04	07	06	03	10	00	-09	-08	-17	-07	-09	-10	-03	25	40	46	56	-03	08	48	17
O	HIROSHIMA	344	35	11	07	01	04	05	14	10	00	-07	-08	00	-11	-05	-07	25	51	52	56	03	06	51	20
K	--YAMAGUCHI	374	31	04	13	13	03	07	12	15	-09	-17	-13	-04	-16	-10	-07	19	47	53	62	-09	-05	40	08
S	TOKUSHIMA	373	51	04	09	08	-03	06	22	25	09	02	-01	11	06	08	07	26	46	53	61	14	19	55	36
I	KAGAWA	366	41	-02	-01	05	-10	-06	03	07	-06	-10	-14	-06	-02	-04	-02	20	56	60	65	06	11	52	22
K	EHIME	379	41	05	13	06	-00	07	22	22	04	01	-01	06	03	09	07	29	47	50	62	12	17	54	33
K	------KOCHI	382	34	02	16	11	04	06	19	27	10	04	03	09	06	14	09	23	46	46	60	16	15	47	34
	FUKUOKA	335	33	-01	11	07	07	05	14	34	12	08	10	18	12	12	15	23	54	56	56	16	18	46	34
K	SAGA	220	15	05	17	15	11	06	05	26	07	09	12	18	20	13	24	24	36	37	31	10	20	29	22
Y	NAGASAKI	255	11	-06	05	09	12	-02	-01	15	-03	-04	-03	12	04	12	12	09	27	32	30	-01	07	19	16
U	KUMAMOTO	283	23	07	14	04	09	06	04	19	-00	02	-00	14	03	08	16	22	44	49	46	05	12	43	29
S	OITA	311	30	13	14	10	22	14	14	20	01	03	05	24	06	20	24	22	34	43	47	11	12	38	29
Y	MIYAZAKI	246	21	13	15	04	20	09	00	09	-11	-11	-08	11	-02	19	13	12	25	32	35	-06	-02	28	18
U	KAGOSHIMA	161	33	24	26	14	24	30	17	22	04	01	01	20	05	11	26	30	31	34	33	12	22	34	36
	OKINAWA	33	-22	-06	-03	-15	-07	-11	-16	-01	-07	-12	02	16	05	24	-04	-15	-10	-11	-07	-07	-15	-14	-02

Table 2 shows that correlation coefficients between neighboring prefectures are naturally high and between prefectures belonging to the same district as well. Those between prefectures of western Japan are still higher. The Central District (Chubu Chiho) seems to be divided into two. The highest numerical value is 0.93, between Toyama and Ishikawa prefectures, and the next highest is 0.91, between Kyoto and Hyogo. These figures are very close to 1.0, and it can be said that states of usage of standard Japanese forms almost coincide between these prefectures. But it should be kept in mind that correlation coefficients became high because the overall ratios of prefectures as a whole (and not the answer of each informant) are considered here.

AICHI
68 MIE
46 80 SHIGA
49 76 90 KYOTO
35 71 84 85 OSAKA
39 72 84 91 84 HYOGO
36 71 82 86 85 85 NARA
51 76 79 77 77 79 84 WAKAYAMA
48 53 58 65 46 63 55 50 TOTTORI
51 53 54 58 38 58 44 47 81 SHIMANE
41 61 68 75 64 76 68 65 75 58 OKAYAMA
41 61 66 70 59 72 66 64 74 70 79 HIROSHIMA
24 46 64 65 52 66 55 57 64 74 64 81 YAMAGUCHI
53 76 71 74 69 73 71 73 55 64 66 68 60 TOKUSHIMA
44 72 77 77 77 78 74 76 54 55 75 72 68 84 KAGAWA
48 69 64 68 60 73 64 70 55 66 66 72 66 86 81 EHIME
42 56 53 56 53 62 60 65 44 59 50 58 59 75 71 85 KOCHI
45 53 53 55 49 57 47 58 39 51 47 63 60 61 62 63 59 FUKUOKA
26 40 28 27 29 35 24 39 12 16 29 21 18 30 35 32 28 56 SAGA
20 34 28 36 34 47 32 41 13 16 36 30 29 43 47 45 40 64 80 NAGASAKI
41 46 42 39 30 45 28 44 26 33 46 47 44 47 52 52 46 74 64 74 KUMAMOTO
37 44 47 50 39 54 41 44 36 49 52 51 55 57 54 62 67 70 45 59 66 OITA
19 30 33 37 26 44 28 35 26 43 41 39 53 44 45 48 53 52 41 56 70 75 MIYAZAKI
34 39 35 42 24 41 22 36 28 33 30 29 30 41 31 40 43 39 36 46 58 49 67 KAGOSHIMA
-13 01 -06 -05 08 03 -02 03 -04 -08 -02 04 01 05 09 07 10 03 22 20 15 09 25 28 OKINAWA

2. Factor Analysis

The relations between prefectures can be known by looking closely at this table. But it is difficult to grasp the gross total interrelations, and application of multi-variate analysis is indicated. Factor analysis is applicable to such continuous values as these ratios of usage for each prefecture. Actually, Table 2 is an intermediate product which resulted from factor analysis.

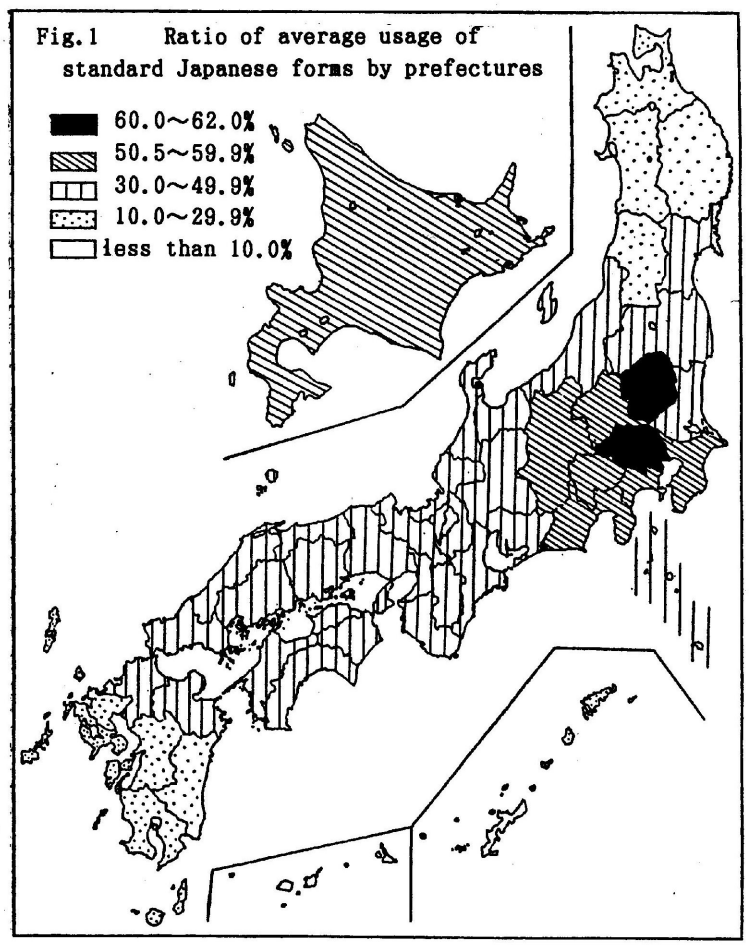

Figure 1. Ratio of average usage of standard Japanese forms by prefectures

The factor analysis was applied considering 82 standard Japanese forms as cases, and 48 prefectures as variables. (There are actually 47 prefectures in Japan, but the Tokyo Metropolitan area and islands off Tokyo were counted separately because there are great dialect differences). Results are shown in graphs of Fig. 2 and Fig. 3, showing the factor loads of the 1st to 4th factors. The map in Figure 4 shows the factor loads of the first to the fourth factors for 48 prefectures. Prefectures are shaded on the map according to the factor loads of the four factors.

Let us now consider the characteristics of standard Japanese forms, comparing the correlation coefficients of Table 2 and the results of factor analysis of Figures 2 and 3.

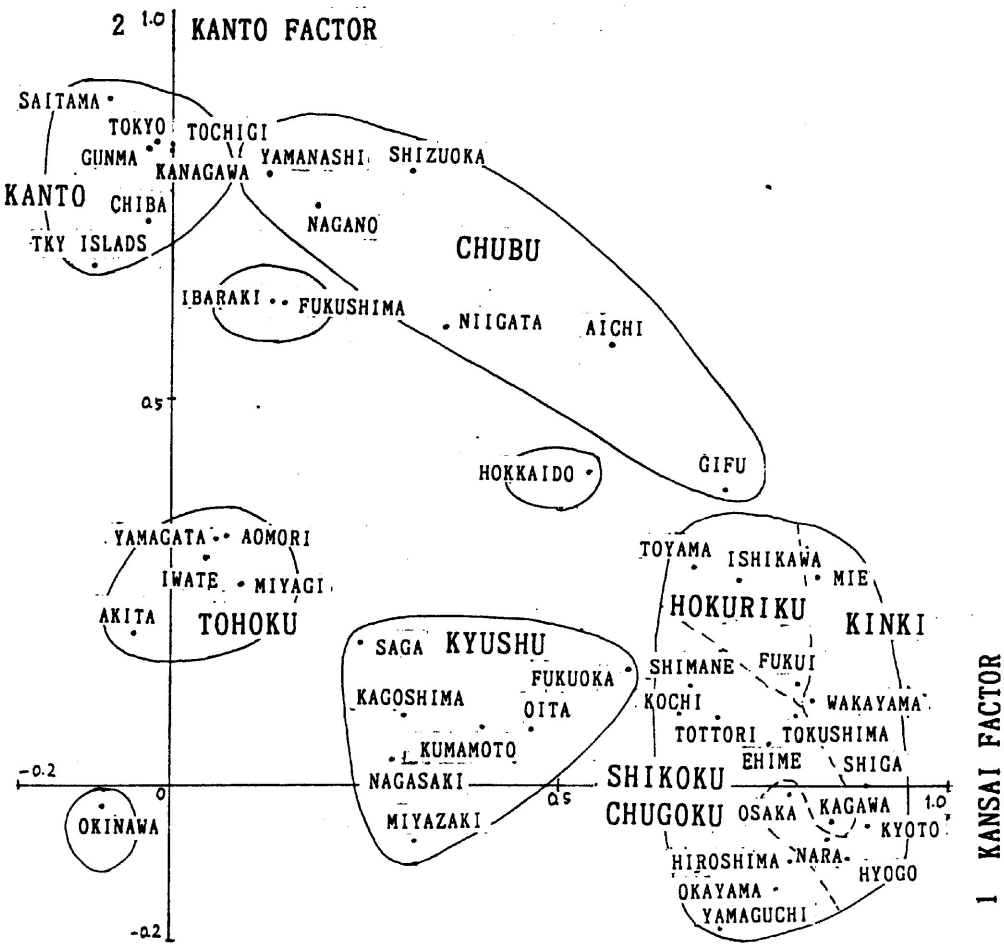

Figure 2. Factor load of 1st and 2nd factor

The first factor can be called the Kansai (Kyoto-Osaka) factor, because the numerical value is large in the Kansai District. Table 2 showed that correlation coefficients between prefectures in western Japan are generally higher. But the average percentage of use of standard Japanese forms (shown in Figure 1 and in the left-most column of Table 2) are not so high for these prefectures. This fact shows that the standard Japanese forms are not used so much in western Japan, but that there is great correspondence between the forms if ever they are used there. In fact, observation of each map of the "LAJ" shows that there are some standard Japanese forms which are widely used in western Japan (but not found in eastern Japan). As shown in other papers (Inoue & Kasai 1982:9, Kasai & Sanada 1982), forms such as "tsurara", "tsuyu", and "shiasatte" are mainly used in western Japan.

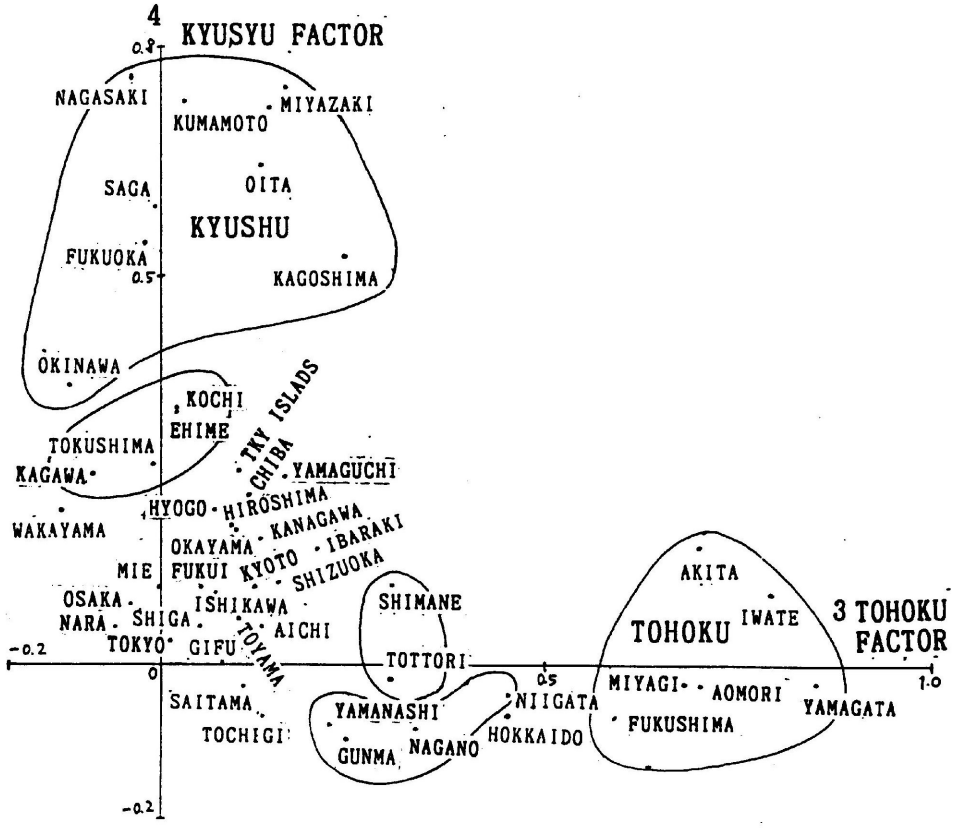

Figure 3. Factor load of 3rd and 4th factors

This shows that there is a large communality between western prefectures as to the use of the standard Japanese forms. That is to say, if a standard form is used in a certain prefecture there, it is used in the other prefectures, too, and if a standard Japanese form is not used in a certain prefecture, it is not used in other prefectures either. Historically, this situation was brought about by the fact that the standard Japanese forms originated in the Kansai District, especially in the old capital of Kyoto and the former economical center of Osaka. These forms must have spread steadily from Kyoto and Osaka to all areas of western Japan in the course of years.

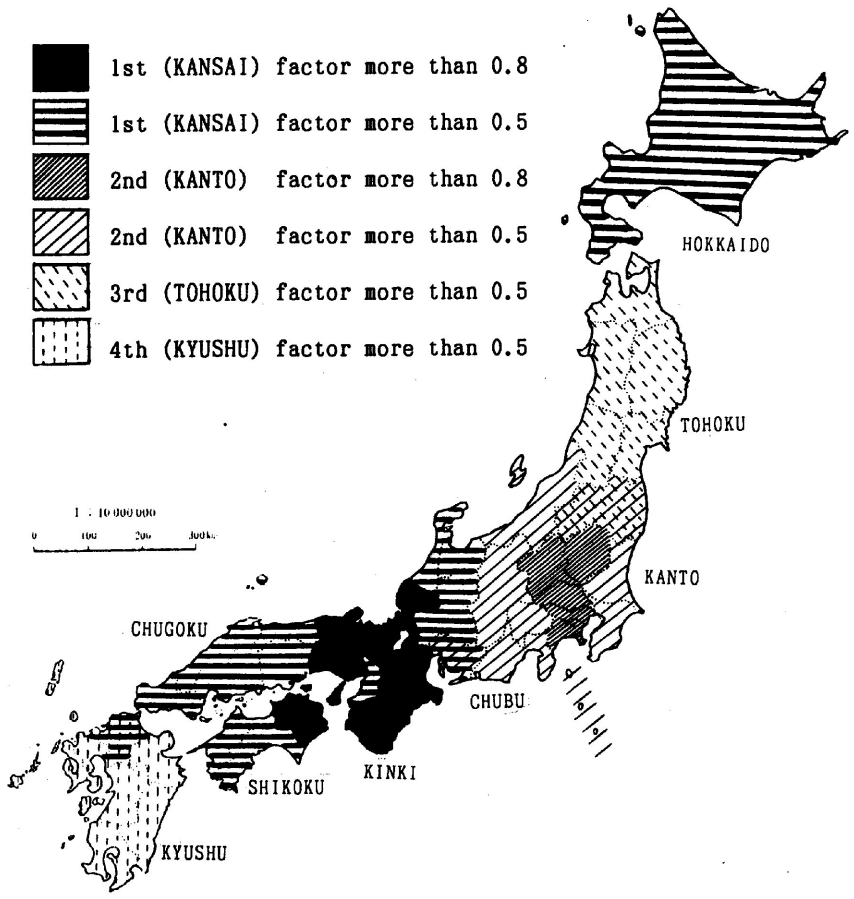

Figure 4. Geographical distribution pattern by factor analysis

The second factor can be called the Kanto (from Kanto, near Tokyo) Factor, reflecting the high correlation coefficients of eastern Japan as a whole, with prefectures near Tokyo as the peak. Table 2 shows that the correlation coefficients between the eastern prefectures (Tohoku and Kanto Districts) are not so high, compared with western Japan. This means that there are differences in the manner of usage of the standard Japanese forms. According to the original maps of "LAJ", the standard Japanese forms which spread from Tokyo often show distribution patterns as if "scattered from the sky" (Sibata 1969). When considered as a whole, these forms are densely diffused near Tokyo, and neighboring prefectures develop disparity little by little, marginal prefectures showing very small figures, as shown by Figure 1 and the left-most column of Table 2. This can be explained elegantly if we consider that the dissemination from Tokyo took the form of a random process, controlled by movements of human beings and flows of information.

Some comments are in order, for better interpretation of the map in Figure 4.

(1) The dividing line between eastern and western Japan can be drawn between the Gifu and Nagano prefectures, that is, just along the Northern Japanese Alps, which were formerly considered to be the border of Japanese dialects on the basis of grammatical maps (see below).

(2) Hokkaido, a frontier in the northern-most part of Japan which attracted people mainly from northern and central Japan, is a little closer to western Japan according to this data.

(3) Some prefectures situated intermediately show overlaps of more than 0.5 of two factors, showing that these prefectures are buffer zones: Fukushima Pref. between Tohoku and Kanto, Aichi Pref. between Kanto and Kansai, Fukuoka Pref. between Kansai and Kyusyu.

The above observations were made because the values of the first and second factors are shown partitioned by 0.5 or 0.8 in Figure 4. If the values were partitioned otherwise, different patterns would appear, so that different observations might be made. Thus it is dangerous to try to determine "dialect classification" only by means of this map. But it is possible to classify dialectally different prefectures because at least four different tendencies were brought out by the application of the factor analysis. While bearing this limitation in mind, we can classify Japanese dialects into four areas: Tohoku, Kanto, Kinki and Kyusyu.

Another division would be: a first division into eastern and western Japan, and a secondary division of east into Tohoku and Kanto, and of west into Kinki etc. and Kyusyu.

This result of factor analysis does not completely coincide with the dialect divisions in the past, which were set up by means of addition or superposition of selected isoglosses; but on the other hand it shows objectively the gradual differences of dialects of Japan. The raw data of dialect usage of Table 1 in the form of a matrix by words and prefectures shows only continuous numeric values for all areas in Japan, so that it would be impossible to "classify" without setting up a boundary of numeric values subjectively. But the application of factor analysis produces at least four different factors, and enables one to divide Japan into four different areas. The result of the factor analysis reflects very well the overall relations of the correlation coefficients as shown in Table 2, and provides a good clue for division of dialects. It also provides insight into the genesis and diffusion of dialect forms. This multivariate analysis produced good results as far as the Japanese dialects are concerned, in which the capital moved from west (Kyoto) to East (Tokyo), and in which eastern and western cultural centers contrast.

There are various kinds of methods of calculation in the factor analysis. Some other methods were also applied to this data, but there were not so large differences as to the resulting factors, that is, in the distribution of prefectures by factor loading, or in the distribution of standard Japanese forms by factor scores. What we have here is the result of principal factor analysis after repeated calculation of varimax rotation.

3. Cluster Analysis

The factor analysis can show distributions of prefectures by means of several factors, but the values themselves are continuous, so that subjective (not to say arbitrary) judgment of the analyser is required, as in the case of cutting the value in 0.5 or 0.8 in Figure 4. Cluster analysis is a method which depends on matrix of continuous values and divides the entities into several distinct groups, enabling subdivision of cases. It has been pointed out that conception of cluster analysis corresponds with the family tree hypothesis in historical linguistics, and that of factor analysis with the wave theory (Yasumoto & Honda 1981). The dis-

tribution of the Japanese dialects is usually explained wave-theoretically, by diffusion process from the two large cultural centres, so that it can be said that factor analysis produces better results. But cluster analysis is more suitable for dialect division in which discontinuous lines are sought. There are also various methods in cluster analysis. The following analysis is based upon the correlation matrix shown in Table 2, and average values are used to calculate the likeliness of the combined clusters.

Figure 5 shows the direct result of the cluster analysis. Okinawa prefecture (Ryukyu dialect) is combined in the last stage, and the eastern and the western part of the mainland Japan form two large clusters. The interiors of two clusters are divided in a similar way to the areal division generally used in school geography. This is convincing because the matrix of Table 2 shows that the Okinawa prefecture has lower correlation coefficients with many prefectures, and sometimes even negative values. And it also shows that the inner correlations within areas are large, but that the correlations between eastern and western Japan are very low. Thus, this result of the cluster analysis coincides with the general impression from the correlation matrix of Table 2, and it probably reflects reality very well.

When other methods of calculation to compose clusters were taken, for example of using the largest value, a similar result to that shown by Figure 5 was obtained. But when the smallest value was used, prefectures were not grouped together, and many clusters were formed, so that the analysis could not be regarded as successful.

Figure 6 is the result of the cluster analysis shown as a map. The pair of prefectures which form primary clusters are connected by "equal" signs. And clusters composed of some number of prefectures are shown by enclosing circles. Upper clusters are enclosed by circles with bold lines. This is a kind of dialect division by means of multivariate analysis.

This coincides fairly well with the results of factor analysis which was shown above. But there are differences, too. One is the position of the Okinawa prefecture, where the quite different Ryukyu dialect is spoken. The factor analysis did not bring out independent factors for this prefecture, though as many as eleven factors were considered. It showed a smaller value than the prefectures of Kyushu in the fourth (Kyusyu) factor. But when each map showing ratios of usage of standard Japanese forms is examined, the special nature of the Okinawa prefecture is clearly seen. So as far as the position of Okinawa prefecture is concerned, the cluster analysis can be said to have brought about more realistic results than the factor analysis. As to the division of the main-

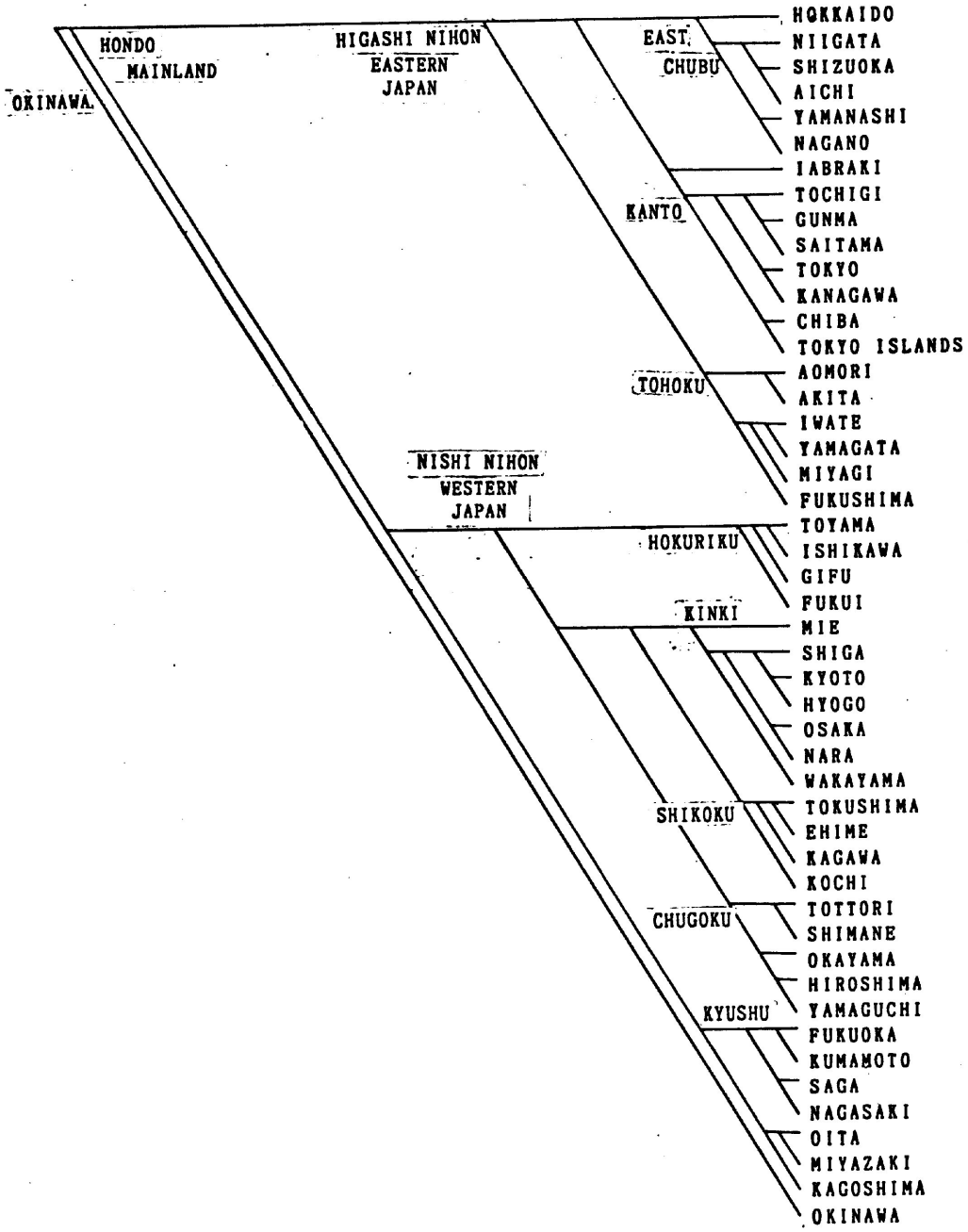

Figure 5. Result of cluster analysis

land Japanese dialects into western and eastern ones, both the factor analysis and the cluster analysis coincide. This is plausible when the correlation matrix or the raw data shown as maps are examined.

On the other hand, as to the grouping of a prefecture into several districts, the cluster analysis showed a clearer result. According to the factor analysis, Tohoku, Kyusyu and Kanto districts showed an inclination to be divided as such, but many prefectures of western Japan are inclined to be grouped together (see Figure 2 and 4). Thus, cluster analysis (method of average value) can be said to have shown the division into each districts a little too extremely.

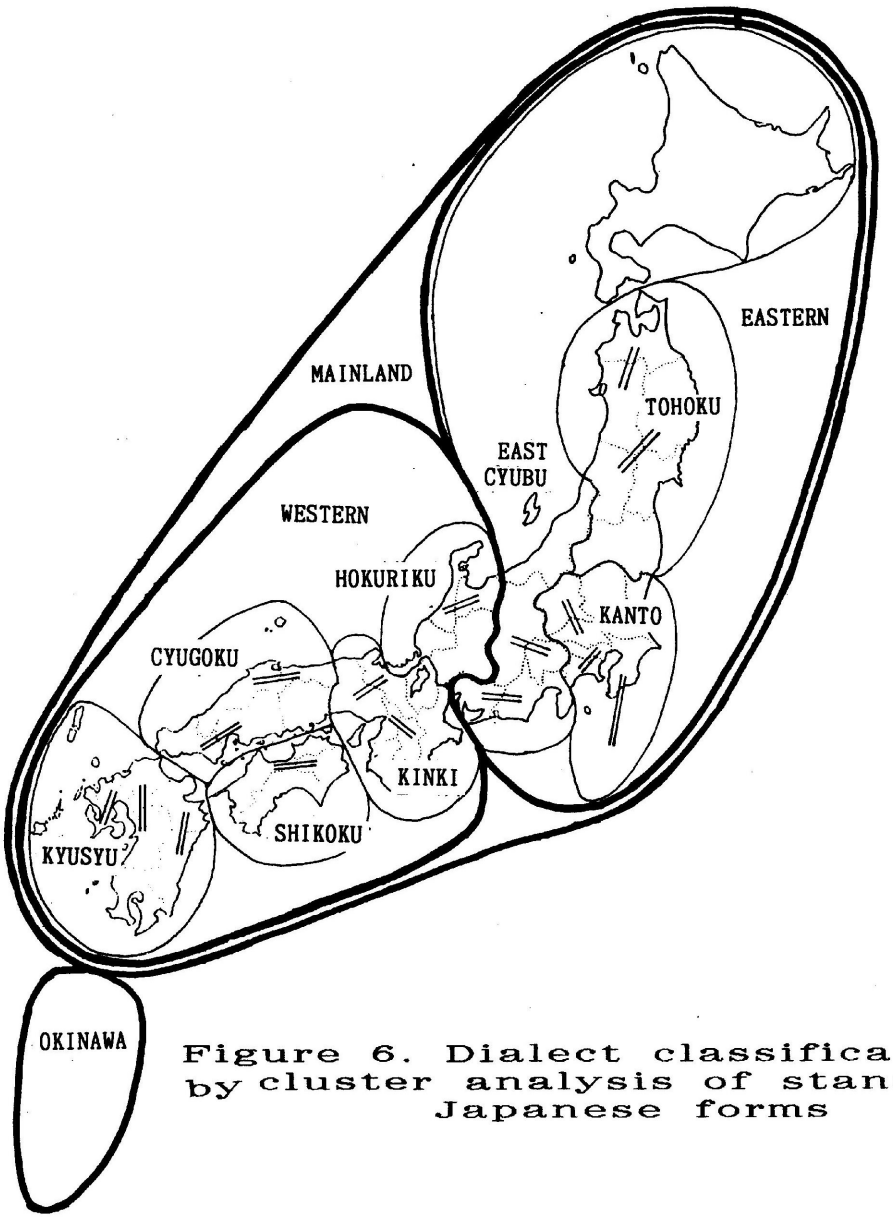

Figure 6. Dialect classification by cluster analysis of standard Japanese forms

But the cluster analysis enabled us to execute the division of dialects by objective (mechanical) calculation, without the influence by subjective factors. Thus the map of Figure 6 is a reasonable result for dialect division which is based on the ratio of usage of standard Japanese forms.

4. Comparison with the Theories in the Past

Here the relation of the result of Figure 6 with the results of dialectological studies in the past will be discussed. As to the location of the dividing line between western and eastern Japan, the result here approaches that of Tsuneo Tsuzuku (1949), which is similar to the findings made about 80 years ago in the 'Report of Survey of Colloquial Expressions' by the Ministry of Education (Kokugo Chosa Iinkai 1906): 'If we try to divide Japan into eastern and western linguistic areas, the line might be drawn along the eastern borders of Etchuu, Hida, Mino and Mikawa Provinces (the modern administrative districts of Toyama, Gifu and Aichi Prefectures).'

This location of the dividing line between east and west coincides not only with many dialect phenomena, including recent results of multivariate analyses of grammatical phenomena (Inoue 1983:6b, 1986:3), but also with sociopsychological images of dialects (Inoue 1983:6a). It has also been pointed out very often in the literature that this dividing line along the Northern Japanese Alps coincides with the borders of various other cultural phenomena, with borders of human movement, and with the flow of traffic and communication which forms the basis of cultural phenomena. (It would exceed the bounds of this study to discuss the origins of this state of affairs in such phenomena as the ancient racial differences between Jomon culture and Yayoi culture, which would lead us into the prehistory of Japan. Influences of contrast between eastern Edo (modern Tokyo) and western Kyoto since the Pre-Modern Feudal Ages (Edo Area) should be taken into consideration.)

This division by cluster analysis of the standard Japanese forms can be said to have produced plausible results coinciding very well with the general tendencies of the language and culture of Japan. But this border does not coincide with those divisions attempted by means of phonology and prosody (accent). So this can not be utilized for a general, overall division of dialects on the basis of the totality of language

phenomena. It should also be pointed out that the lower-level cluster indicating each district does not coincide fully with trials in the past which made use of phonology, accent, grammar and lexicon.

5. Interpretation of the Result

This quantificational dialect division is based on 82 standard Japanese forms. It has not yet been tested on the basis of dialect (patois) forms of the various districts. This will be a task for the future.

However it can be partly defended as adequate that we purely relied on the standard Japanese forms. The ones treated here are answers to the questionnaire of the 'Linguistic Atlas of Japan', which means that they are forms having a definite status in dialects as linguistic systems used in current daily life. The fact that the forms coincided with the standard Japanese is rather due to external and accidental circumstances for the synchronic system of the dialects in question. So it is not out of place to try to divide dialects on the basis of standard Japanese forms.

By the way, the fact that words coinciding with standard Japanese forms are used in a certain district means on the other hand that 'dialect forms' are used in other districts. The contents of 'dialect forms' can be various. So it can be said that using only the standard Japanese forms as basic material is biased. But the forms coinciding with standard Japanese forms need not have had quite different characteristics from the present 'dialect forms' from the beginning. Thus it is reasonable to infer the overall tendencies of various dialect forms.

It goes without saying that in the case of dialect forms there are very many forms which arose independently in different places. Thus the result of factor analysis of the dialect forms will give various factors representing many districts without the biggest influence of only two factors of Kanto and Kansai. But it is predictable that the result will not be very different from that of the factor analysis and the cluster analysis shown above.

As shown above, a kind of quantitative dialect division was made possible by applying two multivariate analyses on the distributional data of standard Japanese forms. The results mostly coincided with past attempts at dialect classification, e.g. the separation of Okinawa dialect and the division of the Mainland into Western and Eastern areas. The

methodological examination also shows that the conclusion here has fairly good plausibility.

The table showing a matrix of percent of usage of each prefecture (see Table 1) was made by Hisako Kasai for her graduation thesis submitted to Gakushuin University in 1980. The data were rendered machine-readable for computation and completed with additional information by the author. The analysis was executed at the computation centers of the Universities of Tokyo and Nagoya, using FACTOR and CLUSTER from the program package SPSS (Statistical Package for the Social Sciences). This paper is a translation of Inoue & Kasai (1982:9), but also includes some figures from Kasai (1981) and Inoue & Kasai (1982:12). The plan, draft and translation of this English version were made by Inoue.

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