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REGROUPING COMMUNES : PERCEPTION OF SPATIAL ORGANISATION IN SOUTH-EAST FRANCE

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1978

France is one of the most centralized countries in the world. Political power, fiscal resources, know-how and ultimate right to decide are located in Paris with the national government. The only elected officials with local authority are the "maires" (mayors) of the "communes." Those local divisions form the true living cells of the country. There are 38 000 of them with an average population (Paris excepted) of some 1.500 inhabitants. Most of them count less than a few hundred persons.

They are today too small in extension, in population and in resources to cope with the needs of local public management. Since 1946, the government has proposed no less than eleven different reforms tending to regroup them, without any success. The last effort [1] tends to shoulder away many unpopular tasks and to defuse regional activism. The opposition is advocating regional policies with similar goals. Arguments for regrouping seem very strong : economies of scale, better management through the hiring of a technical staff, development of local life, highly profitable contacts between local producers, possibility of presenting a common front towards the central government... Nonetheless all plans have failed : a basic factor must have been overlooked. This paper tries to identify it¹.

In Vaucluse, a south-east *département* located some 100 miles north from Marseilles, we made a survey among elected local officials, asking them to indicate the communes with which they would like to regroup in a small local federation. The goal was to recover perceived spatial organization and to identify the motivations standing behind those choices.

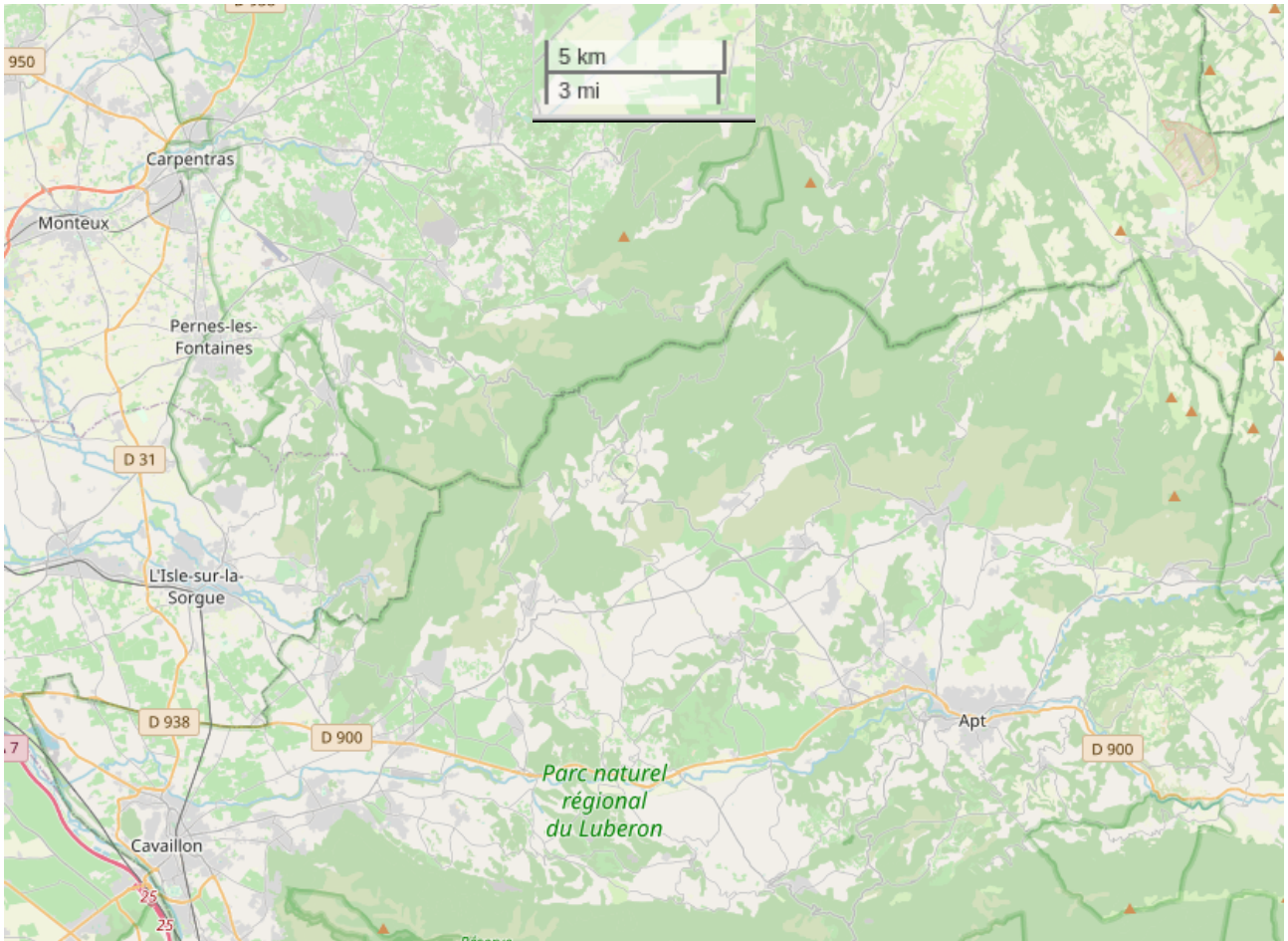
STANDARDIZING AND UNFOLDING THE DATA MATRIX.

Two main groups of communes emerged from the survey : around the city of Carpentras (30 000 inhabitants), and the city of Apt (11 000 inh.). The answers were recorded in a connectivity matrix.

Let C be the set of communes who quoted at least once the local center (Carpentras or Apt) or were quoted by the center's elected official. The set C has been ordered according to the population of the commune : any $c_i \in C$ is more populated than any c_j iff $i < j$. Such ordering is a basic requirement of the method used here. Let M be a function mapping the Cartesian product $C \times C$ on a binary set $(0,1)$. M is a connectivity matrix where $c_{ij} = 1$ when the commune i wants to be grouped with j , 0 otherwise.

M is not symmetrical : this is the basis of the whole study.

¹This study is a small part of a larger project funded in 1977-78 by the Ministère de l'Intérieur, D.G.C.L. Its aim was to propose a method for regrouping the communes in federations with a common purpose, inner solidarity and the ability to manage themselves. I wish to thank warmly J.L.Guigou, G.Maspero and J.Nasser, my co-researchers, for their help. Errors are mine.



STANDARDIZING THE RAW DATA

The first problem is to get rid of the idiosyncrasies of the elected officials who answered. Some of them want to regroup with every-body : their corresponding row in the matrix is full of 1's. To make the answers consistent, we assumed that :

- 1) a column sum is truthful : it shows how much a commune is desired (objective connection).
- 2) conversely, a row sum measures the desires of a commune and is not very reliable (subjective connection). Every row has been divided by the total of the corresponding column. Let :
 - M_o be the original data matrix,
 - J_o a diagonal matrix such that

$$J_{oij} \in J_o = \sum_i m_{oij} \text{ (column sums)}$$
 - I_o a diagonal matrix such that $i_{oii} \in I_o = \sum_j m_{oij} \text{ (row sums)}$

Then, the standardized matrix M_1 is

$$M_1 = I_o^{-1} J_o M_o$$

This model avoids the personal bias among answering officials by weighting their answers with the opinion of all the other officials.

UNFOLDING THE MATRIX M_1

Since the communes are ordered by decreasing population, the two halves of the antisymmetrical matrix M_1 have different significations. The upper half-matrix contains the policies of the large centers ("dominants") towards the smaller ones ("dominated"). Conversely, the lower half-matrix represents the grouping policies of the small centers in front of the big ones. Except for the local capital and the smallest center, each commune appears in two opposite roles : the matrix antisymmetry represents the dialectical policy of each center split between two different attitudes : towards the more powerful, and the smaller local units. We assume that sheer size is a good substitute for economic power.

We want to distinguish clearly those two attitudes ; let us define two symmetrical matrices :

- P such that $p_{ij} = p_{ji} = m_{ji}$ with $i < j$,
- Q such that $q_{ij} = q_{ji} = m_{ij}$ with $i > j$;

In M_1 , P and Q, the diagonal contains naturally 1's. P represents the grouping policies of all centers as dominants, and Q the policies of the same communes as dominated by larger centers.

THE SPATIAL GROUPING

A principal components analysis of both matrices P and Q would offer the classical difficulties of analyzing connectivity matrices with binary measures. It is easier to derive from P and Q two correlations matrices ; a high coefficient between two communes means that their grouping policies are very similar : they wish to be included in the same group.

A Principal Components Analysis of such matrices is straightforward.

The groupings of the "dominants"

Results of the first factors are shown on figures 1 and 3 where 40% of variance or more are concentrated.

- the larger city (the capital) wants to be grouped with almost all the other communes : its loadings on most axes is around 3 or 4. ;
- communes of different sizes and at different distances from the capital are group together ;
- the general result is a sort of pattern in sectors : each group is made of the capital city plus a long radiating strip of communes of different sizes extended from the center till the periphery.

The "dominated" policies (Fig. 2 and 4)

- the capital city is always absent from all groups ; its loadings are nil on all axes but one, its own factor ;
- communes grouped together tend to have similar sizes and to be located at approximately the same distance from the center ;
- the resulting pattern is somehow circular : communes located at the north, the west and the south of the capital city group together in a circle avoiding the main center.

The maps show clearly two different policies of the same communes, depending if they decide from a strong position (dominants) or from a weak one.

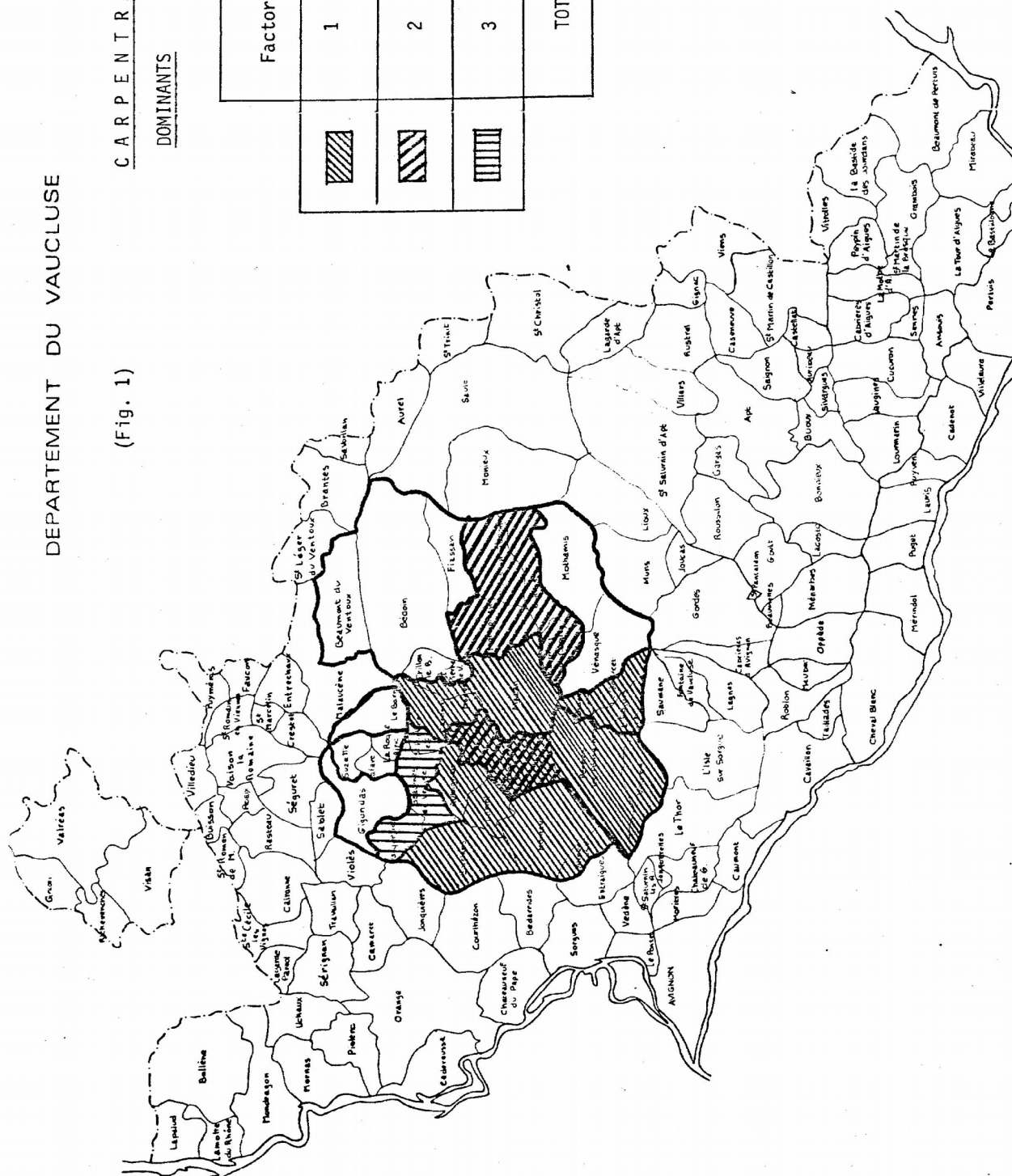
DEPARTEMENT DU VAUCLUSE

(Fig. 1)

CARPENTRAS

DOMINANTS

Factor	% of variance
1	21.3
2	10.9
3	7.5
TOTAL = 39.7	



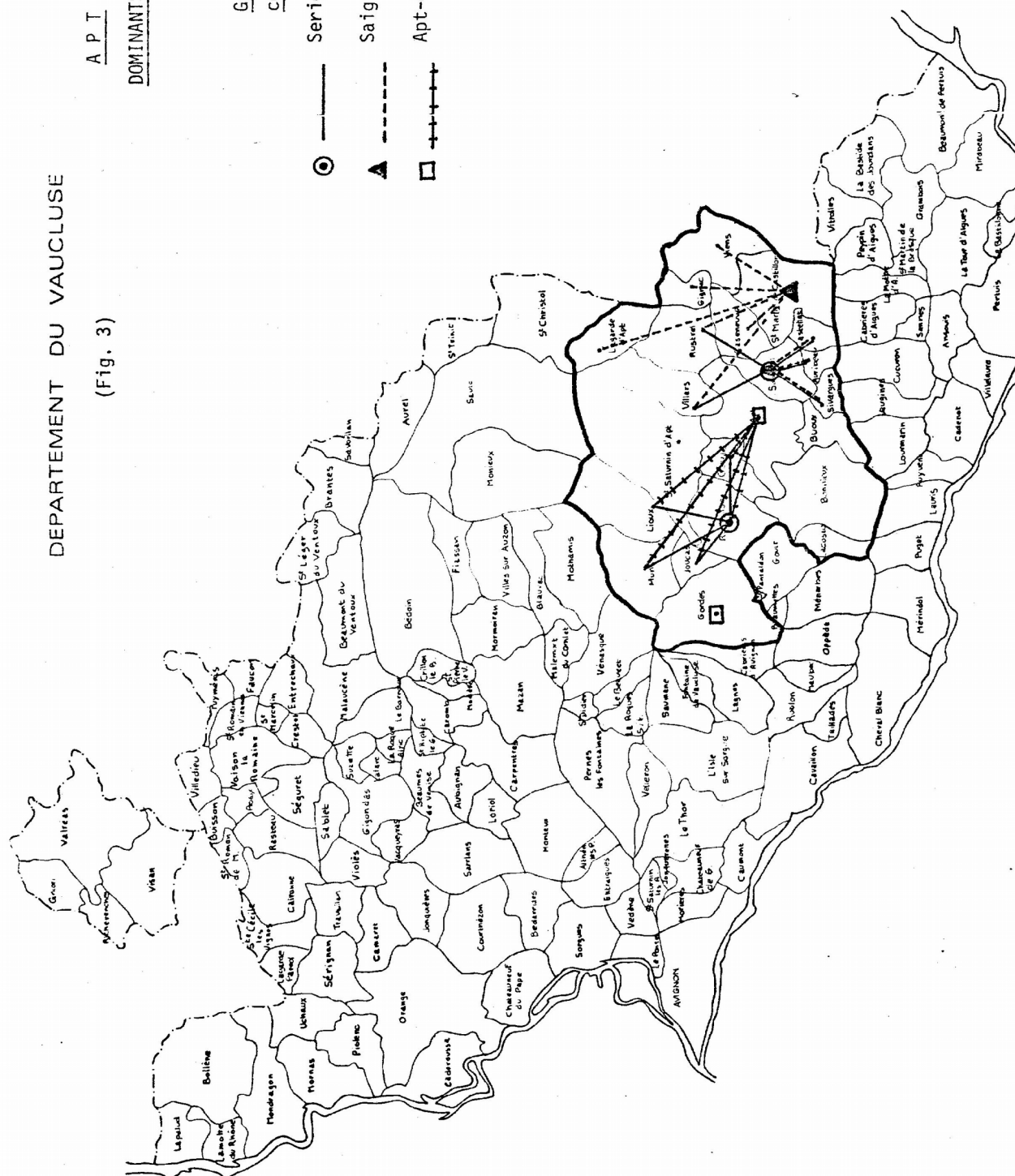
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(Fig. 3)

A.P.T.

DOMINANTS

- Grouping
conflicts
- — Serignan-Roussillon
 - ▲ — Saignon-St Martin de Castillon
 - — Apt-Gordes






DEPARTEMENT DU VAUCLUSE

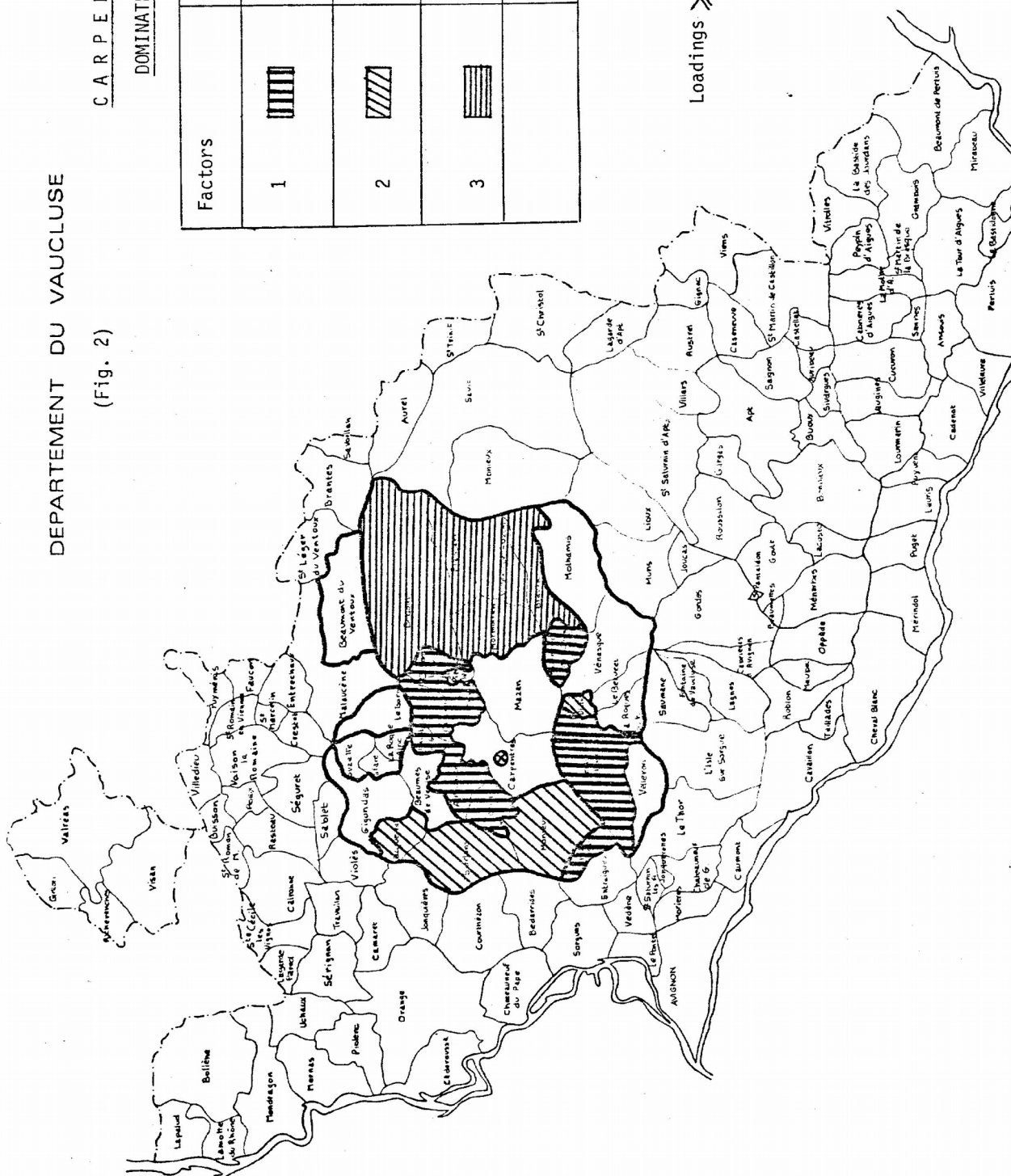
(Fig. 2)

CARPENTRAS

DOMINATED

Factors		% of variance
1		31.2
2		8.6
3		14.1
		$\Sigma = 53.9$

Loadings $\geq .7$

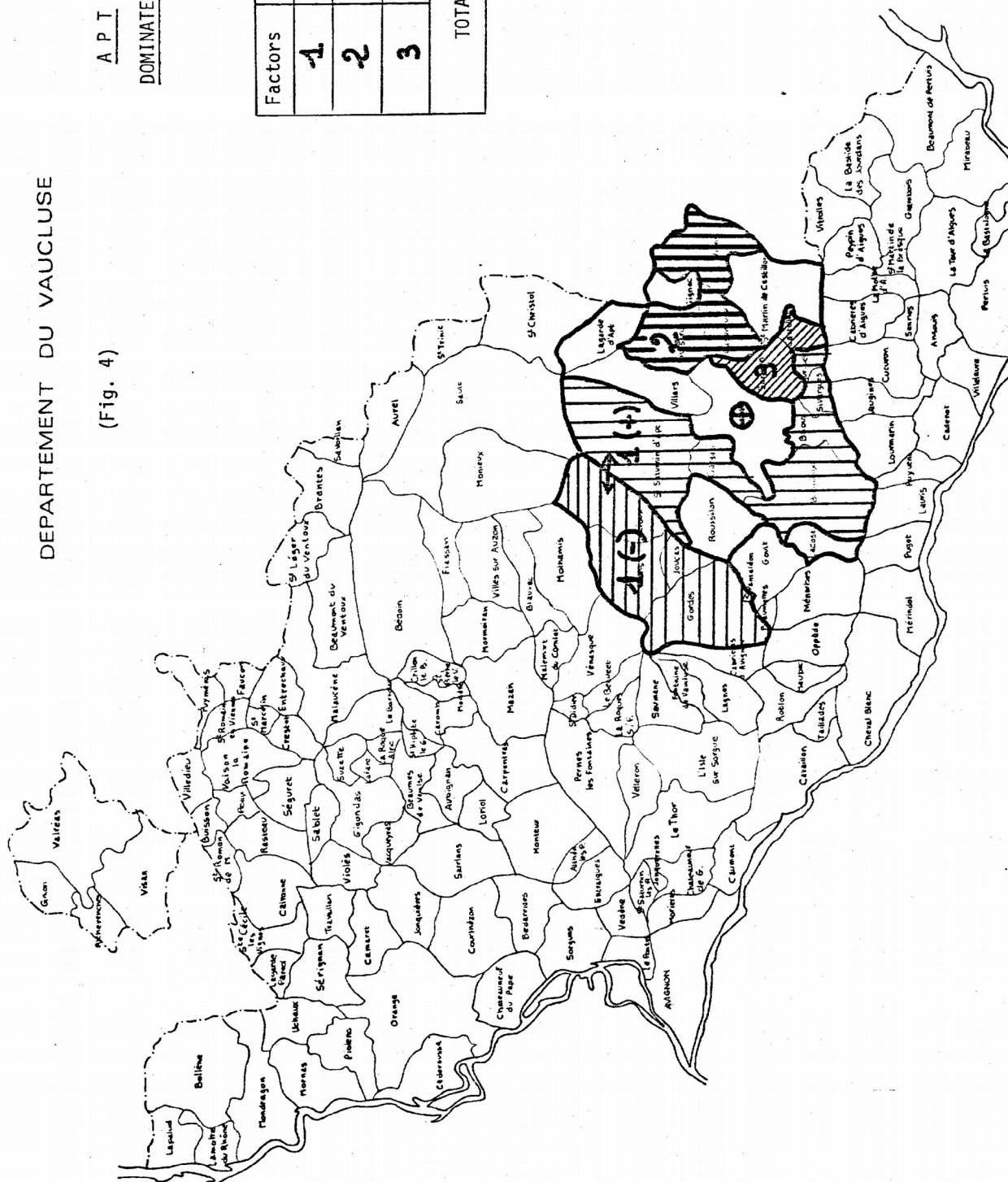


DEPARTEMENT DU VAUCLUSE

(Fig. 4)

A P T
DOMINATED

Factors	% of variance
1	21.
2	14.4
3	11.8
TOTAL = 47.2	



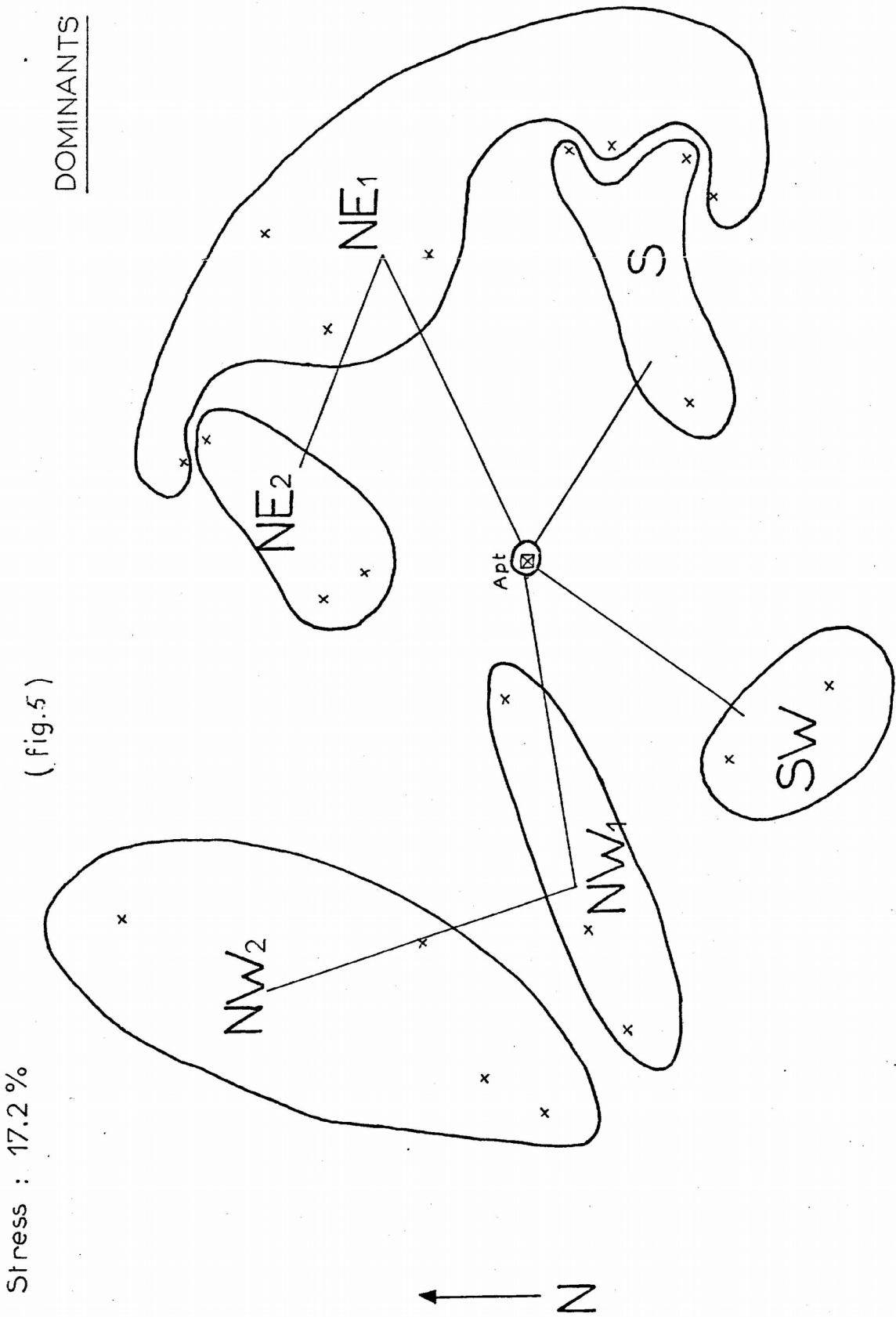


TABLE 1. Relative heterogeneity of the group of communes
interms of size and distance to the center.

Coefficients of variation of	Regions	Dominants =====		Dominated =====	
		APT	CARPENTRAS	APT	CARPENTRAS
<u>Distances</u> to the central city.	C.V.=	0.673	0.355	0.549	0.232
		0.458	0.483	0.231	0.141
		0.420	0.207	0.289	0.274
<u>Populations</u>	C.V.=	0.983	1.671	1.952	1.139
		0.984	1.749	0.207	0.677
		1.361	1.186	0.794	0.750

TABLE 2. Kruskal-Wallis test of the group of communes as ordered
by the coefficients of variation of population and dis-
tance to the central city. (values of the observed χ^2)

Coefficients of variation of	Regions	Dominants =====		Dominated =====	
		APT	CARPENTRAS	APT	CARPENTRAS
<u>Distances</u> to the central city.	χ^2	7.96	8.22	12.06	12.95
<u>Populations</u>		42.63	3.38 =====	6.49	10.76

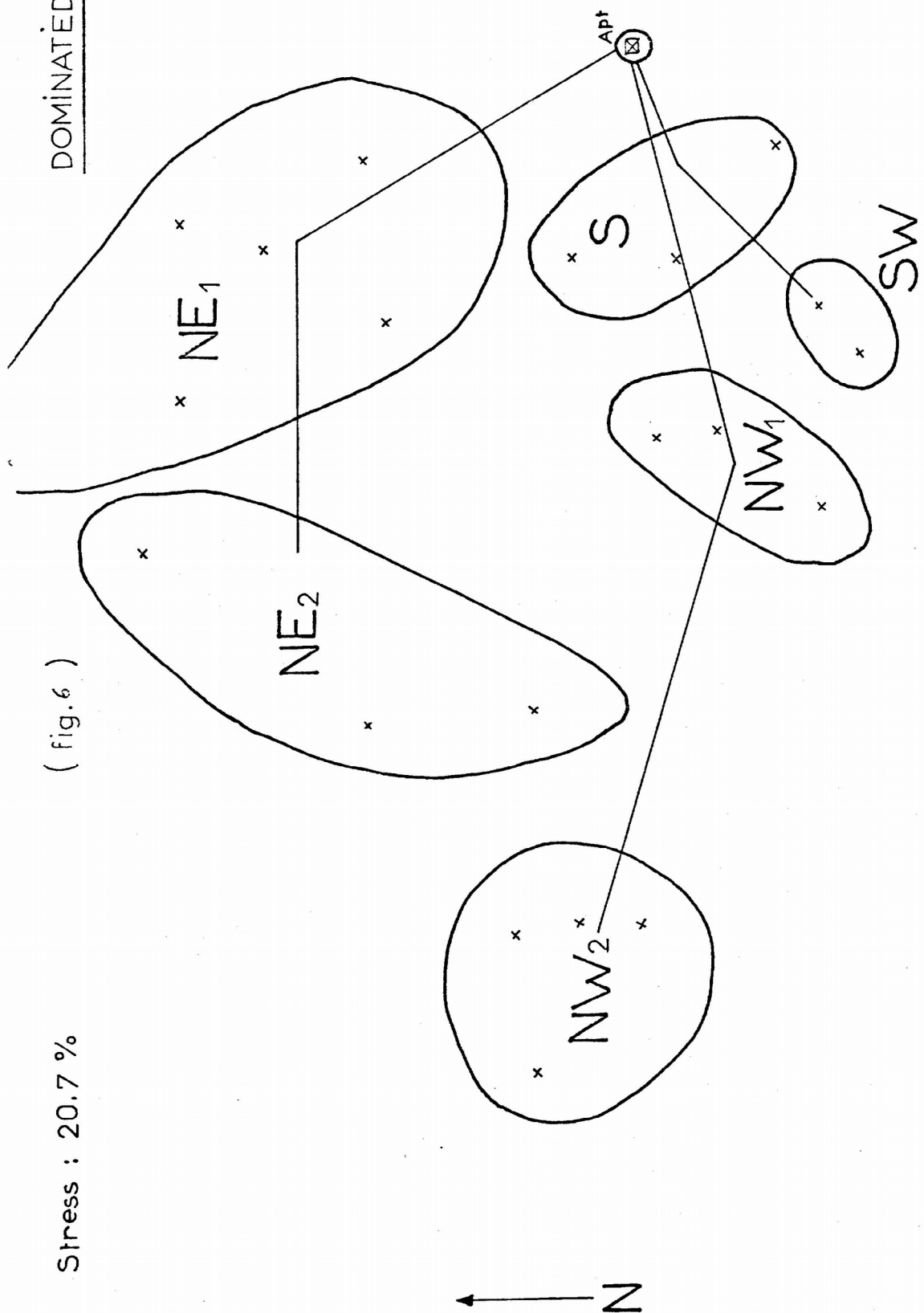
N.B.- Chi-Square threshold with 3 d. f. is

at 5 %	=	7.82
at 10 %	=	6.25

Stress : 20.7 %

(fig.6)

DOMINATED.



MAPPING THE LOCAL POLICIES

Let us try and give another representation of those patterns before trying to interpret them. The preceding correlation matrices show how close communes policies are. Those coefficients, however, are no distances (they do not observe the triangular inequality). Let us measure distances between policies on the trigonometric circle, through an arc-cosine transformation of the correlation coefficients. Those distances in radians are small when two communes have similar grouping policies, large when they differ strongly. Through Multi-dimensional Scaling, it is then possible to redraw a map of the regions, locating the communes as they want to be (*fig. 5 and 6*) : the "policy map", exhibiting the deformations introduced by the grouping policies. (*See table 1*)

Dominant policies

Figure 5 shows the new configuration taken by the communes when they want to regroup from a power position.

- communes are located quite close to the central city (in the case of Apt, this city lies in the middle of the cloud). Typically, the central city wants to be part of most groups.
- sub-regions are elongated : larger centers are fighting each other in order to have in their group many of the smaller communes ; e.g., group NE 1 in Apt's region, splits under the attraction of NE2, South and Apt itself (*fig. 5*)

Dominated policies (*fig. 6*)

- The central city is always aside : all the communes, which are smaller, avoid it and try to escape its influence ;
- sub-regions are much more compact : small communes stand shoulder to shoulder against the big ones.

Spatial policies of the communes are definitely contradictory, depending on the position they decide from : power or weakness.

INTERPRETING THE RESULTS

It seems the only criterion for grouping used by the communes is the criterion of power, with its dialectical character : a commune tends to avoid at all cost to be regrouped with a bigger one, but at the same time, tries to regroup with smaller communes it will be able to dominate.

There seems to be a pattern as far as population of communes, and distance to the central city are concerned. The hypothesis we propose is :

- *dominated* communes try to aggregate with communes of similar population and located at the same distance from the central city;
- *dominating* communes want, conversely, to regroup with communes of dissimilar population and situated at different distances from the center.

Confirming the hypothesis

Table -1 shows the *coefficient of variation* of both variables (population and distance to the center of the region) for the principal groups of communes extracted through principal components analysis. It is not possible, of course, to compare the groupings one-to-one ; populations of the *dominants*, however, are always more heterogeneous than populations of the *dominated*, which verifies the hypothesis for this variable. Distances to the main city are also more dispersed in all the groups of dominating communes, but one (group 3). Given the little information we had to begin with, the hypothesis seems well verified.

A question remains however : any random grouping of communes would produce different coefficients of variation. What is the probability that pure randomness (in grouping the communes) would not offer an ordering of the coefficients of variation similar to the pattern observed ?

Testing the hypothesis

The Kruskal-Wallis test allows us to answer the question, without any assumption on the data, since it is a non-parametric test :

- Groupings by *dominated* communes, according to populations and distances are all significant at the 5 % level. (See table 2)
- Grouping by *dominants* communes are also significant at the 5 % or 10 % level, but only in the Carpentras region, when population is concerned.

This exception might show that communes chose their grouping in the general power game indicated above, more by insisting on their geographical position on the map (i.e in terms of their distance to the city they fear or they desire to control), than in terms of population, i.e in economical terms. This would be important but it needs to be confirmed by further studies

SPATIAL GROUPING AND THE POWER GAME

Our goal was to exhibit the inner contradictions affecting the judgment of local officials when choosing a spatial organization. Power is the name of the game : increasing control or avoiding control is the basic theme in grouping communes. This may explain the multiple failures of the central government trying since decades to promote grouping policies based on economical and managerial arguments. Such arguments have never yet convinced local authorities, because they were blindly (or was it blindly ?) directed towards decreasing costs or managing better when the main problem was radically different : how to preserve, in a country so centralized, the few parcels of power escaping still from the central authority.

Actually, the problem is still deeper : parallel to the pyramid of administrative cells, from the commune to the nation, there is a pyramid of social groups enjoying power and privileges at each level of the hierarchy. To regroup smaller cells into a unit of size x means decreasing the power of social groups who were local bosses at the discarded smaller levels ; simultaneously, groups controlling power (political and economical) at higher levels, above x , are not affected by the grouping; it profits mainly to groups whose interests coincide with the geographical level x . In other words, at each level of the geographical scale reign one or several social groups who will benefit or suffer from any change in the hierarchy of levels. Social conflicts and spatial autocorrelation are narrowly related. If behind the elaborated arguments for regrouping or not regrouping communes appears only a pure power game, behind this power game itself lies the true motive of all those

tensions : conflicts of interests between different social groups (local landowners, local notabilities, agricultural companies at a larger scale, industrialists,...).

If this is the real problem, it is not surprising that each commune presents inner-contradictions in its policy : the dialectics of power appear practically in the antisymmetry of the original connectivity matrix. Unfolding this matrix in two symmetrical matrices is then a way of analyzing mathematically dialectical relationships.

An interesting confirmation can be found in the standardizing process itself. The original matrix M_0 was transformed in M_1 by “double scaling” :

$$M_1 = I_0^{-1} \cdot J_0 \cdot M_0$$

Instead of stopping after one iteration, let us continue the standardizing n times ; then,

$$M_n = \left(\prod_{k=0}^{n-1} I_k^{-1} \cdot J_k \right) M_0$$

Under which condition does the process converge ? We want

$$M_n = M_{n-1}$$

for any n sufficiently large. The necessary and sufficient condition is that M_{n-1} be symmetrical : in plain words, when the subjective and objective policies of the communes are equivalent. Dialectical contradiction disappears and the pyramid of communes becomes stable : the spring is broken, and tensions vanish. This is not a realistic situation. In practice, social contradictions will exist and relationships between communes will remain antagonistic.

The initial information contained in the two raw connectivity matrices was quite scarce. It is in such cases that statistical and mathematical methods are the more needed and the more useful. Reliance on factor analytical methods has led many people to believe that we can use mathematics only with abundant and reliable data. This study tries and make the opposite point.

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- [1] O. GUICHARD (1977) *Vivre ensemble, rapport sur les collectivités locales*, La Documentation Française.
- [2] J-L GUIGOU, B MARCHAND, G MASPERO, J NASSER (1978) *Lecture de l'espace et développement, micro-régional*, IRU-ENVIRONNEMENT, Institut d'Urbanisme, Université de Paris-Val-de-Marne (Paris XII), 2 volumes.