A SOCIAL GEOGRAPHY OF VOTING BEHAVIOUR IN SYDNEY AND MELBOURNE

by

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G.H.
1972

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SECTION ONE: OVERVIEW

> ...some of the things that people do with their voting slips would make you split your sides. We discovered one old lady cursing and swearing in a corner shouting "Where's the bloody top to this thing" whilst trying furiously to shove her voting slip through the radiator.
>
> - letter from my brother

Unfortunately this is one type of voting behaviour which has not been investigated by this thesis. The humour, idiosyncrasy, and rich individuality of people escapes the methodology, which is statistical, dealing with aggregates and abstract patterns.

The study may seem to be far removed from the old lady cursing the radiator, or from those other pungent expressions of political belief, but there is an excuse for this. Firstly the collection of personal anecdotes is valuable, but much too delicious and wayward for academia. Secondly the more abstract morphological approach has been too much neglected in electoral research, and this is a surprising thing considering the valuable type of information it has to offer.

CHAPTER I

INTRODUCTION

There can be little doubt that geographical factors influence all kinds of behaviour, not just because both the behaviours and the factors happen to have geographical distribution, but because the structure of the environment at any time limits certain activities. For instance Dye (1966) found that for the U.S.A. political policy was typically more dependent upon economic geography than upon the political system characteristics. Others (e.g. Butler and Stokes 1969, Capecchi and Galli 1969, Dogan 1969, Pelling 1967, Prescott 1959) make it fairly clear that geographical factors contribute significantly to the moulding of political predilections. Amongst other things this study attempts to define one form of structural development of pattern by which party preference becomes a non-simple function of socio-economic status in Australian cities.

1. Aims

The aim of the thesis is to analyse the geographical relationships between voting variables and sociological factors in two Australian cities (Sydney and Melbourne) and for one Federal election (in 1966). It is concerned with (i) the influence of any geographical patterns upon aggregate voting behaviour, and (ii) the description of regional combinations of relationships within the cities.

What the thesis is not concerned with, in particular, are (i) the analysis of individual behaviour (aggregate data only is used), (ii) an in-depth analysis of one election, (iii) a detailed analysis of causal process.

The study is of the morphology of static patterns at a macro scale, and of the relationships between these patterns. The method aims to extract the maximum possible information out of supplied statistical data without extensive and time-consuming resampling, extensive fieldwork or interviewing. The latter was considered to be a job for a Ph. D; this Masters thesis is however concerned

with methodological efficiency in the use of easily available data, and consequently also with the type of suggestions which may or may not be made on the basis of the results.

In chapter 6 a new method is presented, one which is deductive and hypothesis generating, and this method gives some original results. Although stress is laid upon logical correctness where possible, the major results of the study are themselves logically hypothesis generating. It is here that the thesis departs from the common hypothesis→test strategy of research and becomes a hypothesis→analysis→hypotheses strategy. The aim is productivity and fruitfulness rather than sheer logical correctness. Nevertheless the results are examined in the light of current theory and findings, and some inferences are restricted to suggestion only.

2. Review

There are many studies of the distribution of sociological factors in the city (e.g. Abu-Lughod 1969, Berry and Rees 1969, Daly 1968, Dent 1968, Johnston 1966, Jones 1968, Shevky and Bell 1955, Wheeler 1968), but there have been only a few which have related these factors to voting behaviour for an entire city (e.g. Cox 1968, McPhail 1970). Although some studies investigate the influence of the local sociological context upon individual voting behaviour (Cox 1969, Ennis 1962, McPhee and Ferguson 1962, Putnam 1966, Segal and Meyer 1969), I know of none which specifically analyse the geographical relationships implied in this influence - though Cox does take areal scale into account. Similarly at the level of aggregate-only analysis, there have been no quantitative studies (to my knowledge) which specify for a city how sociological patterns may influence political behavioural patterns geographically - that is studies which go beyond a simple correlation, specifically including an explicit geographical effect.

It has been assumed that regional regularities of voting behaviour correspond to regional regularities of some sociological factors, but that at least two types of

regional pattern need to be specified for a city. The first is one of combinations of different patterns, and a proposition here is that there will be typical combination patterns for regions within most cities, and that these will not follow the patterns of relationships obtained for the whole city. The second type of regional pattern reflects a deviation-amplifying process, where given an existing geographical pattern, a second one will build upon and around it according to a specific geographical function. Both pattern types are analysed in this study, but the second type is based upon an initial framework discussed below.

3. Variables used

The main voting behaviours looked at are party preference (using the ALP[1] vote), turnout, and the informal vote; these are detailed in chapter 4.

Social area analysis (Abu-Lughod 1969, Berry and Rees 1969, Janson 1969, Jones 1968) was used to obtain three main sociological factors, these being socio-economic status, life-cycle stage (an age related demographic factor), and a composite of variables clustering geographically in the city centre, descriptively called 'city centrality'. These are detailed in chapter 5.

It was hoped to include a variety of geographical shape and distance measures, and also topographic, and land economic measures into the analysis but time and difficulties in data collection prevented this. A measure of distance from the CBD[2] and a within - region distance measure were used however.

These are the main variables used in the study; where possible a variety of others were incorporated as checks upon extraneous influences.

---

1. ALP = Australian Labor Party.

2. CBD = Central Business District. This measure was given a log 10 transformation because of skew.

4. Initial framework

A deviation amplifying process is one where a mutual causal relation amplifies an initial kick, builds up a deviation, and diverges from the initial condition (Maruyama, 1963). If a residential pattern of social characteristics be taken as the initial kick, and the behaviour of residents or potential residents is viewed in interaction with the existing residential pattern, then a deviation amplifying process exists whereby areas of high or low status can develop a kind of self-generating momentum and stability over time (Maruyama, 1963; Firey, 1947; Pahl, 1965; Musil, quoted in Pahl, ibid; Jones, 1960; Morrill, 1965). There is an aggregate perception of the social area, and feedback communication between people in their own residential area. It has been observed frequently that individuals are influenced by group effects (Cattell, 1962; Secord and Backman, 1964; Ennis, 1962; Putnam, 1966; Segal and Meyer, 1969; Butler and Stokes, 1969) and that the effect of the group is greater than the sum of its parts.

This leads on to the main initial assumption of the thesis, that given a residential social area, then from this initial kick a wide range of behaviours will be influenced by the social contagion effect of living in that area. The deviation of one's social status will be amplified in behaviour by interaction with others from one's social area, or by perception of the area's norms and values (Campbell, 1958). One type of behaviour thus amplified is voting behaviour; because the party vote is associated with socio-economic status, then the pattern of %ALP voting in particular is considered.

According to the framework, the pattern of %ALP voting should be some form of amplification of the socio-economic status pattern. What the form takes is unknown, but clues to this can be obtained by plotting the residual from the correlation between %ALP and socio-economic status. This residual distribution would exclude the direct effect of socio-economic status, leaving the amplification pattern (if any).

At least two pattern deviations between three pattern levels are thought to exist for the city. The first level is a combination of the physical and human reasons for the establishment of the settlement in the first place. This level is basic and incorporates patterns of business and industry, and natural physical features. The pattern of residential social characteristics is the second level, and it is posited to be a deviation amplification of the first pattern. The third level is a behavioural pattern, which deviates from the social characteristics pattern. It is the second deviation, but not the first, which is analysed in this thesis.

In this initial framework each succeeding pattern level developes upon the preceeding pattern, amplifying certain elements of it. Pattern flexibility and speed of change over time increase at each level, but the simple idea of pattern development has been used to postulate a regional contagion of party voting behaviour.

5. Hypotheses

The hypotheses developed are, briefly:

(i) that the ALP voting pattern will be correlated with at least two components: direct socio-economic status, plus an extra regional effect based upon socio-economic status,

(ii) that because there are a number of different subsystems within the city, there will be different combinations of voting behaviour in different parts of the city, and that relationships within subregions of the city will be different to those obtained for the whole city.

The reasons for these hypotheses are given in greater detail in the relevant sections of the thesis, and some subsequent corollary hypotheses are given there also.

6. General method

The three voting variables were checked against possible extraneous influences and then used as dependent variables. To obtain the three sociological factors, seventeen variables

from the census householders schedule were selected on the basis of previous studies and factor analysed.

The basic method used to obtain relationships is correlation analysis, using the simple, partial, and multiple forms as required. Simple correlation relationships were obtained for the whole city and for within-city regions using the voting variables and census factors, and also using a distance from the CBD measure.

In order to obtain relatively objective regions, a regional grouping method was used, grouping by single or multiple variables as required. This was used firstly to derive regional combinations for analysis, and secondly as a part of the method in the deduction of a regional contagion pattern for the party vote.

This method defines the second hypothesised component to the party vote - contagion in relation to socio-economic status - and gives a measure of it which is subsequently used in correlation analysis.

On the basis of both the results of this study and upon theory, suggestions are made about casual processes, and for lines of further research. The analysis is non-experimental and partially deductive (non hypothesis testing) and so causal relations can only be suggested.

7. Form and process

> Morphological theory is that which advances statements about regularities of the structure of phenomena. Explanatory theory advances statements about the mechanisms that underlie these regularities.
>
> (Alonso 1964, p.165).

Concern for the different orientation of, and interaction between studies of form and process is an old one in geography, and is common in the history of all sciences. This study is one of city structure and is therefore primarily morphological; it firstly generates hypotheses about city form, and consequently hypotheses are further generated about city process.

In studying voting in the city, the historian or sociologically oriented political scientist is primarily concerned with those influences upon voting such as social class, age variation, social interaction, the effects of issues and events, membership of voluntary organisations and cultural societies etc., and often in fine detail. To them 'explanation' is of the causal process type. The electoral geographer usually studies the relationships between broad geographical patterns of phenomena, discovering and defining new patterns and relationships if he is lucky enough. He should not be ignorant of nor immune to the insights of the explanatory process methods, and indeed some are now trying to combine the two types of method. His interest is primarily morphological however, and to him 'explanation' is usually in terms of the statistical variance (of geographical patterns) accounted for. Few studies are restricted to an analysis of either form or process alone, and whilst this study defines some morphological relationships between voting behaviour and sociological characteristics in two cities, an attempt is also made to theoretically account for both the development and interaction between the patterns over time, and (as a first approximation and for the existing scale) to suggest an explanation in terms of causal process.

8. Human ecology

'Human ecology' is taken to mean the two-way interaction between human beings and their environment, ranging from the influence of broad patterns of physical events to their behaviour within friendship groups. Within this study an 'ecological effect' is taken to mean that the behaviour of an individual is influenced by his location in a social aggregate. If the effect is operating, then this means that an individual will behave differently according to whether he is in a social aggregate or not, or according to the type of social aggregate that he is in (Dogan and Rokkan, 1969, is a collection of articles on this topic; the 'group effects' references of section 4 above are also relevant). The social aggregate may be a 'natural' phenomenon, such as a friendship group, or it may be an

areal unit containing aggregate data. The important difference from the point of view of research is that areal units are far more modifiable by scale and shape, etc., and so their boundaries (containing the aggregate) become more important (Valkonen, 1969). An ecological effect can be demonstrated by comparing the regression lines for two variables, one line based upon individual data, and the other based upon aggregate data (Tannenbaum and Bachman, 1964; Duncan et al, 1961; Valkonen, 1969). If there is an ecological effect, then the slope of the aggregate data line will be steeper than that for the individual data line (e.g. Duncan et al, 1961, p.123), signifying a stronger relationship for aggregate data.

As Valkonen (1969) has detailed, if there is an ecological effect, then the correlation between X and Y when based upon aggregates (the 'ecological correlation') is different to that based upon individuals (the 'individual correlation'). When areal aggregates are used, then the bigger the areas and the larger the ecological variance[3], the higher the ecological correlation is when compared to the individual correlation (Valkonen 1969, p.61). Although there is no direct evidence of the size of the difference between the individual and the ecological correlation in this study, the high correlations between the %ALP vote and socio-economic status, the large areal units used, and the typical findings in other studies of an ecological effect upon party vote (see chapter 6) would suggest that an ecological effect upon the party vote existed in this study.

However this is not of crucial importance for this study, for this thesis further differentiates between (i) a simple ecological effect, in which the general social context influences individual behaviour generally, and (ii) a 'regional contagion' ecological effect, in which there is a distinct gradation of ecological effect within

---

3. The ecological variance is the variance of the averages of the aggregates.

a region. The latter may simply be a subcategory of the former, but empirical studies are divided roughly into the two types (see chapter 6).

Generally, people living in an area are thought to be influenced by the aggregate norms and values of that area. The precise mechanisms of influence are unknown, and these are probably multiple with variations from place to place. It is thought that daily interaction with others from the area - friendly, formal, verbal and non-verbal etc. - gives an information exchange which is a component, in addition to a person's more stable social and personality characteristics, which guides behaviour. Where the information exchange is predominantly of one type, e.g. the norms and values associated with social status and the Liberal Party vote, then this component will influence peoples voting behaviour in addition to their own social status to the extent that more would vote for the Liberal Party than could be predicted upon the basis of individual status alone. This is the simple ecological effect, and the regional effect is simply a distinctive variation of the strength of the ecological effect within regions. There are a number of assumptions involved in its analysis, but these are discussed in chapter 6.

For simplicity three types of measurementunits are categorised in this analysis, and these are (i) the individual, (ii) the aggregate, a spatial grouping of people here, (iii) the global attribute, for instance the type of electoral or social system within which the study is set (Dogan and Rokkan, 1969, ch 1). In addition three types of functional variables have been categorised, these being (i) behavioural, (ii) social characteristic, (iii) physical, including the human topographic landscape. Each type of variable can be categorised into the three types of measurement unit.

SECTION TWO: PRIMARY METHOD

'Holy God ! Wot are dese den? Eh?'
He looked around for an answer. 'Wot are dey?' he repeated angrily.
'Legs.'
'Legs? LEGS? Whose legs?'
'Yours.'
'Mine? And who are you?'
'The Author.'
'Author? Author? Did you write these legs?'
'Yes.'
'Well, I don't like dem. I don't like 'em at all at all. I could ha' writted better legs meself. Did you write your legs?'
'No.'
'Ahhh. Sooo! You got some one else to write your legs, some one who's a good leg writer and den you write dis pair of crappy old legs fer me, well mister, it's not good enough.'
'I'll try and develop them with the plot.'

- Milligan, Puckoon

The 'legs' with which readers wander through this research are written by the author. The methods used, orientations, and development of ideas are fixed only in the most general sense before research begins. As the plot develops, so, usually, do the legs.

Nevertheless so that the reader may critically examine his legs, an account of their detail follows, written by the author.

CHAPTER II

DATA BASICS

The collection, selection, status, and presentation of the data each limits the type of analysis and the type of information output for a study.

1. One election and two cities

The regularities in voting behaviour over space and time (e.g. 'blue-ribbon' seats) are a common finding in electoral research and a major difficulty in analysis is that of separating out the changeable from the more regular effects for any election. Butler and Stokes (1969) identify three types of change: physical replacement of the electorate, changes in the electorate's 'enduring' party alignments, and the response to issues, personalities, and events for a particular election.

The resources of this study make an adequate analysis of change impossible, and so this leaves the more contentious and subjective opinions of professional observers to serve as the analysis of change. Because of the inherent unreliability of this type of information it has been used sparingly.

Every election is idiosyncratic in some ways, and so a measure of change between two elections will contain (i) a measure of 'regular' variability in voting - the swinging rather than the safe seats would score high on it, (ii) some variability due to the specifics of each election. Such a measure would contain the influence of all three types of change previously mentioned, and could be used as a crude check on the influence of election idiosyncrasy.

Because the Federal electoral boundaries were unchanged between the elections of 1961 and 1966, a direct measure of change could be calculated, using a regression transformation (chapter 3). The correlation of the %ALP vote between elections is expectedly high, and the transformation gives a residual which is a measure of change independent of the 1961 values. The advantage of this type

of measure over a straightout subtraction is in its independence from the set of values at the prior time (Ferguson, 1966). The specificity of the 1961 election is thus excluded from the measure.

This measure of change is still fairly crude, because it takes into account only two elections, but it has been used where a quantitative analysis of the effects of change is required. Fortunately the spatial scale of the analysis is such that small spatial fluctuations are smoothed (i.e. within electoral divisions, see 2. below), and consequently the derived patterns of change is less variable over time than it would be if smaller areal units had been used.

The correlation between the %ALP vote for 1961 and 1966 was r = .966 for Sydney and r = .954 for Melbourne. Because of the scale of the analysis, and because election specific variation at this scale is so minor (e.g. the average of 8% unexplained variance[1] for the two correlations is an estimate of the variation), it was considered that the election specific variation would not greatly effect results. Admittedly the precise degree of the effect is unknown as a precise measure is not possible within the limits of this study. Rydon (1963, p.169) reports that most Australian electors are not interested in politics or in a specific election, so it does seem that the results are quite likely to be generalisable to the same two cities for other elections, though obviously the longer the period generalised for the more the first two types of electoral change mentioned will affect results. Australian cities other than Sydney and Melbourne should show similarities, though more changes would become apparent the more city size decreased. Both the Australian electoral system and urban social system differ to some extent from their counterparts in other countries, yet some striking similarities are apparent upon comparing the results of

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1. The percentage unexplained variance is $(1 - r^2) \times 100$.

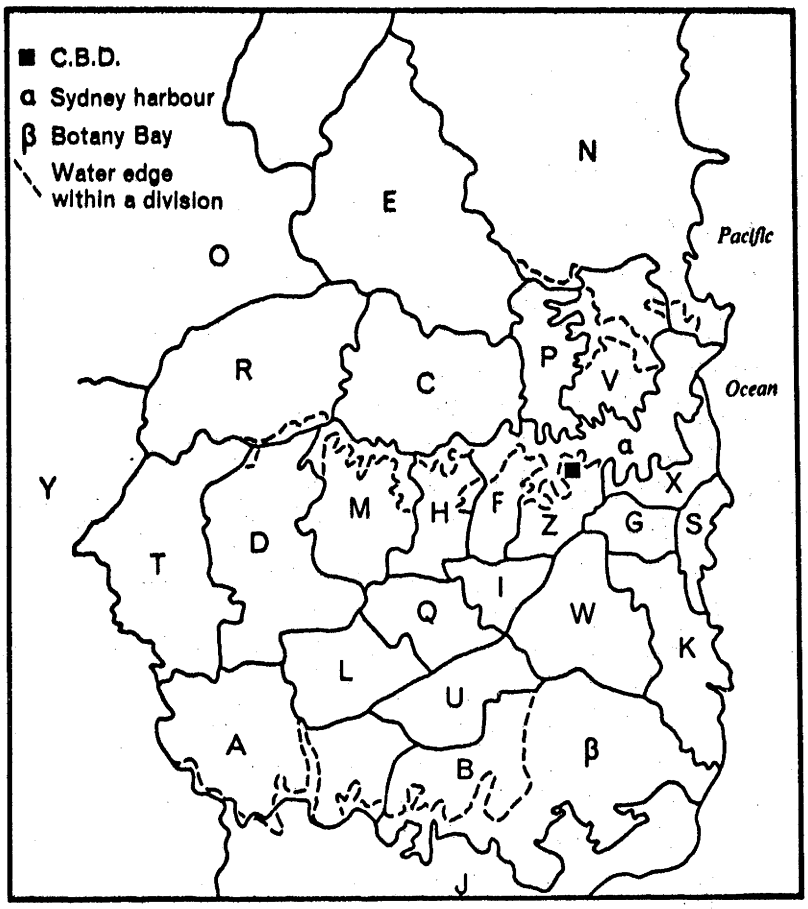

Figure 1a. Sydney Electoral Divisions 1966

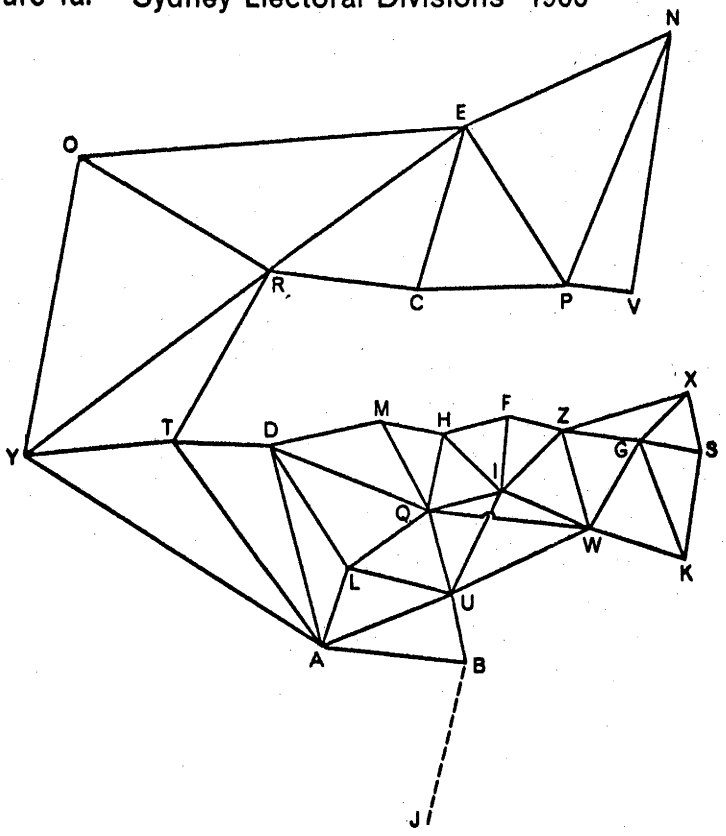

Figure 1b. Network of electoral division connectivity

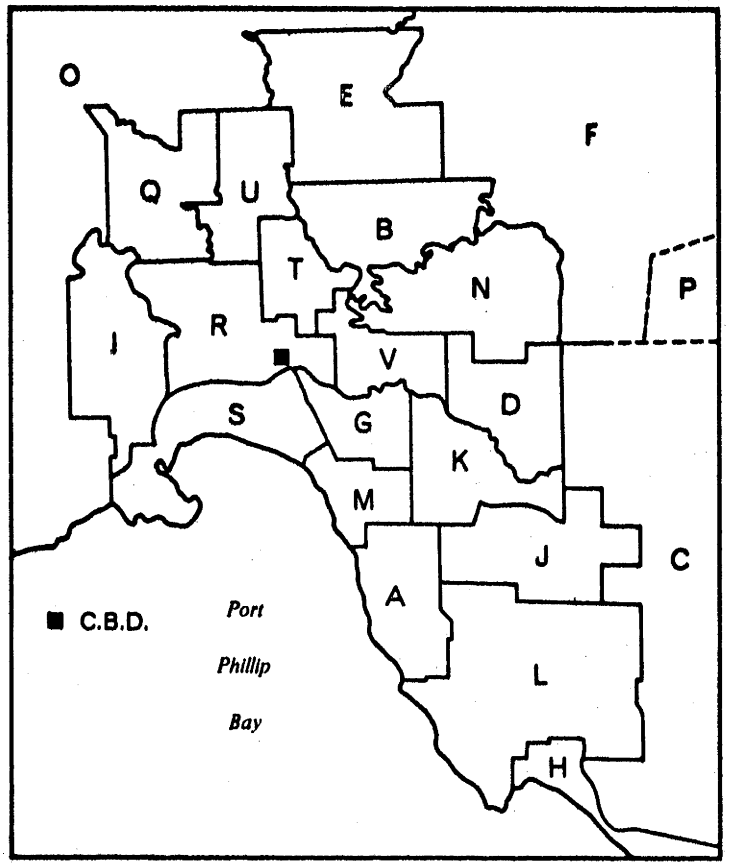

Figure 2a. Melbourne Electoral Divisions 1966

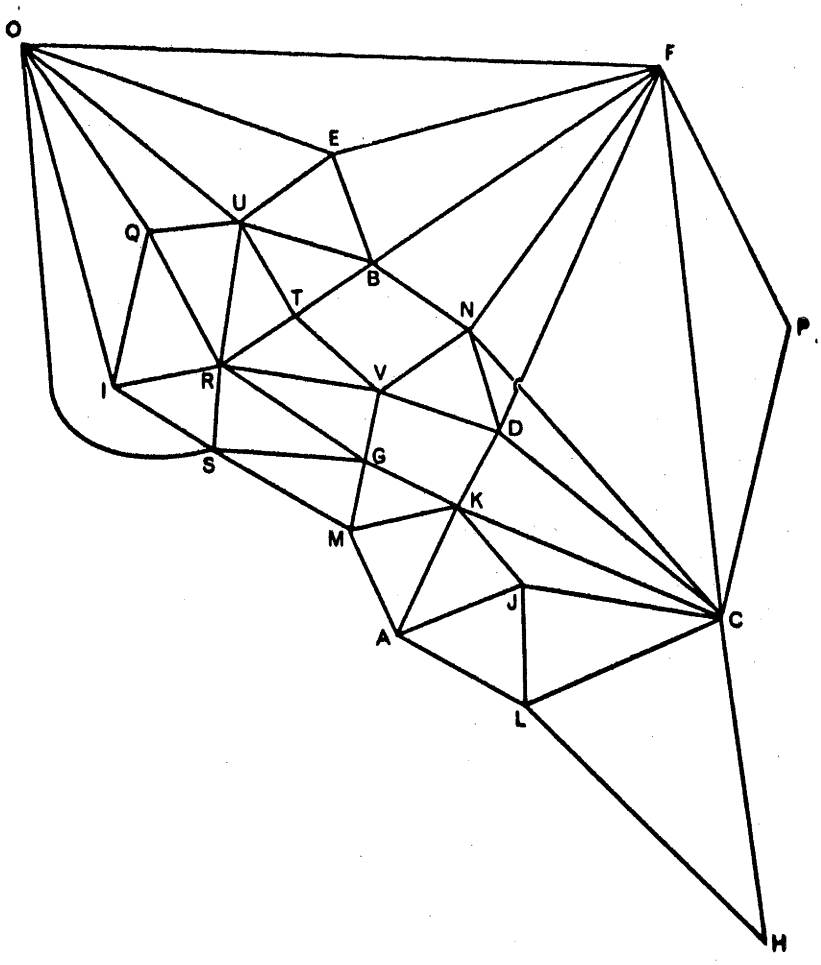

Figure 2b. Network of electoral division connectivity

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Sydney

A. Banks
B. Barton
C. Bennelong
D. Blaxland
E. Bradfield
F. Dalley
G. East Sydney
H. Evans
I. Grayndler
J. Hughes
K. Kingsford-Smith
L. Lang
M. Lowe
N. Mackellar
O. Mitchell
P. North Sydney
Q. Parkes
R. Parramatta
S. Phillip
T. Reid
U. St. George
V. Warringah
W. Watson
X. Wentworth
Y. Werriwa
Z. West Sydney

Melbourne

A. Balaclava
B. Batman
C. Bruce
D. Chisholm
E. Darebin
F. Deakin
G. Fawkner
H. Flinders
I. Gellibrand
J. Henty
K. Higgins
L. Higinbotham
M. Isaaca
N. Kooyong
O. Lalor
P. La Trobe
Q. Maribyrnong
R. Melbourne
S. Melbourne Ports
T. Scullin
U. Wills
V. Yarra

Cox's (1968) study with the results of this study. Replication is needed to overcome the sampling limits of both time and place; any unusual results obtained from this study will provide leads which others may check and follow up.

2. Number and size of electoral divisions.

Electoral divisions have been used as the basic units of research because of the difficulty, in terms of time taken to manually collate, in obtaining smaller units. There are 26 divisions in Sydney and 22 in Melbourne (figures 1a and 2a), and the number of electors they contain ranges from about 30,000 to 100,000 (Electoral Returns). The divisions are obviously large and there are few for each city, and a number of implications follow from this. Firstly there will be some spatial smoothing of pattern, as averages are obtained for the division's aggregate population, and this would most likely give higher r values in correlation (where r is a measure of association). The r values are for patterns at the particular spatial scale of electoral divisions, and so any inference is logically limited to that spatial scale. Secondly, because large areal units are used, there is likely to be an increase in any simple ecological effect, when compared to the use of small areal units, again giving a higher r value for patterns influenced by the effect. Thirdly there is an obvious loss of detail which makes some but not all pattern analysis difficult. In some cases there is a possibility that the averages computed for an electoral division may be inadequate summaries of the characteristics of the division, and in particular the relations between the characteristics may not be adequately captured by the relations between the averages (e.g. for nonlinear or discontinuous relations). This is a problem with all aggregate data, but one which increases with the size of unit. It is possible to use the variability of the dependent voting variables, as measured by the supplied values for subdivisions within a division (Electoral Returns), as a check upon the adequacy of the spatial scale in discriminating pattern, but this is still a crude check.

Repetition of the analysis using other cities, other time periods, and other scales of areal units would help in assessing the generality of the findings of this study. Nevertheless for this study the obtained patterns of relations are strong; although there is some expectation of high correlations because of the size of areal units used, the strength of the relations is very high, and in the hypothesised direction, and is consistent with theory. Objections to the relations would be serious if the patterns were weak and did not fit in with either theory or hypotheses.

3. Status of the data

The data can be regarded as a sample (over time for the two cities) or they can be used descriptively for the one election and two cities. By Act of Parliament electoral boundaries must be redelineated every five years, and so existing electoral divisions could be regarded as areal samples, dependent upon the 'boundary sampling' of redistribution. Thus they could also be regarded as being a unit-sample of a continuous spatial series.

As the use of one election and two cities is more a case-study approach rather than being an approach using an extensive sampling design, it is more appropriate to regard the electorate data as a population rather than a sample. Inferences are logically limited to that case-study, but of course the results of the study can become hypothesis generating, particularly if they relate to general theory.

For some cases where the sampling of pattern seemed to be important, e.g. for the number of factors to use in the factor analysis, then inferences based upon random sampling were used as a guide.

Spatial series are being sampled, but there is a very basic problem here. The values for units measuring a nonrandom space series are not independent (e.g. each value being more similar to its neighbour than to values further away) and so for nonrandom spatial patterns the inferential criteria of methods requiring independence are intuitive guidelines only. Logically, significance tests cannot be

used because of the lack of independence (see chapter 3, part 5). Because the thesis is a case study using dependent values, correlation analysis of spatial pattern must be strictly non-inferential.

4. Selection and collation of data

Voting figures were obtained from the Electoral Returns, and percentages computed from these figures (chapter 4).

The selection of the social and demographic data posed more problems, as the only easily obtainable data is that from the census, and this has limitations of type and of geographical unit. For instance information on rents and incomes is not available, and so surrogates such as occupation and education are used instead.

Following the practice of social area analysis and factorial ecology (Abu-Lughod 1969, Berry and Rees 1969, Dent 1968, Jones 1968) census variables were selected with view to using factor analysis to reduce the data matrix to basically the socio-economic and life-cycle-stage factors (chapter 5). A pilot study (Herbert, G, 1969) indicated that the 17 census variables finally chosed for this study would give the required factors.

The matching of the electoral division data with the census data was done by using census field codes to aggregate census collectors districts to electoral divisions. In a few cases the areal match was not exact, but the overlap constituted less than 1% of a division's area, and would hardly contribute much to error. The collectors district values were collated manually to obtain the electoral division values.

The 1966 census collected data for the 30th June, whilst the 1966 election took place on the 26th November. Although little permanent population movement could be expected during these five months, some seasonal movement could have effected figures. However as people vote on the basis of their permanent address, seasonal movement is probably not that important for voting figures. The precise nature of any discrepancy due to the five month lapse is

unknown, but is probably not very important for the broad patterns of voting behaviour observed in this study.

5. Mapping and connectivity

Because the spatial scale of electoral divisions is relatively macroscopic for city patterns, containing and smoothing much variation, then it was considered that this smoothing would be most clearly represented by using form-line maps rather than choropleth maps or any other form of map.

The approximate population centre of each electoral division was taken and form-lines were then drawn in relation to these points. The choropleth map can give a false impression if unit boundaries are not related to the general trends of pattern, but isopleth maps can be similarly inappropriate where there are few points, e.g. at the city periphery. The form-lines were used because they gave a clearer picture of a continuous, smoothed pattern.

The regional grouping program linked together only those divisions specified as being contiguous. In most cases there was little difficulty with this, but some variations had to be considered. The reason for grouping regionally here is an assumption of spatial diffusion of social, demographic, and political characteristics. Thus if a boundary traversed only uninhabited bushland then diffusion between divisions was not assumed and nil contiguity was allocated (e.g. between Werriwa and Hughes in Sydney). Water barriers posed another problem, for although bridges exist, the spatial and physical barrier is usually a very effective barrier to any process of sociological diffusion (Jones 1967) and is often an effective barrier in human perception (Schelling 1960). There are many rivers, creeks, and canals in cities, and so only a very large body of water was taken to be a limiting barrier; this restricted this type of barrier to Sydney Harbour - Parramatta River and to Botany Bay - Georges River in Sydney. In the latter case Hughes would have been separated from the rest of Sydney, and so was joined to

Barton (there are three connecting bridges) in order for it to be included in the analysis.

The final graphs of connectivity used for the regional grouping program are given in figures 1b and 2b.

If distribution values are converted into standard scores, they can be compared directly, i.e. the value of the standard score for one variable for an electoral division is directly comparable to that for another variable for the same division. Similarly the maps of standard scores can be compared directly. The score is given by $Z = (x - \bar{x})/s$, where Z is the standard score, $\bar{x}$ is the arithmetic mean, s is the standard deviation, and x is a value within the distribution.

The Z distribution has a $\bar{x}$ of zero, a s of one, and the scores usually lie within the range of $\pm$ 3 from zero. A plus sign is given to a Z above the mean and a minus sign to one below the mean. In mapping the Z scores an interval of 0.5 is used for form-lines and the zero-mean line is emphasised. The lines were drawn in relation to the electoral division points and no other information was used in their mapping.

Provided that the distribution is normal, approximately 5% of it will lie beyond $\pm$ 2 from the mean, whilst approximately 68% of it will lie within $\pm$ 1 from the mean. Thus a ready appreciation of both densities and significant extremities is given in the pattern of standard scores.

CHAPTER III

CORRELATION ANALYSIS

This chapter explains the uses of and the limitations of the methods basic to the study. These methods are explained extensively in order to illuminate the constraints upon inferences imposed by the nature of the data. The technical texts generally used by the author are Nunnally, 1967; McNemar, 1969; Yule and Kendall, 1948; Ferguson, 1966.

1. Pearson's r

The correlation coefficient r is a measure of the degree of relationship between two variables, whilst r^2 is an arithmetic measure of the amount of variance of one variable accounted for by the other. Either can be used to assess the relative importance of a number of variables in predicting a dependent variable. The coefficient has a range of $\pm$ 1, with zero representing no relationship and $\pm$ 1 being either a perfect positive or negative relationship.

There are some assumptions involved in the use of r however. Firstly, if sheer description of the degree of (linear) relationship is required, then r can be used for almost any numerical data of any distribution shape; obviously though a non-linear measure would be more appropriate if the relation was strongly non-linear. Secondly, if inferential statistics are to be used with r, then the distributions of the two variables should be bivariate-normal, i.e. the relation should be linear, each variable should be normally distributed, and the relation should be homoscedastic (the spread about the fitted line should be approximately the same at all levels of the two variables).

The latter three conditions are usually related to each other but need not be so. In most cases however, if either or both distributions are skewed, then log transformations can be used to reduce the skewness and to give bivariate normality; the latter can be checked by plotting the bivariate distribution.

The r coefficient is used in this thesis almost wholly with interval-scale data, but in one case the point-biserial r (r_{pb}) is used. For this a binary measure is correlated with an interval-scale measure, and the upper limit to r_{pb} is given as about $\pm$ 0.8. Both r and r_{pb} are identical in basic formula and assumptions, though the equivalence to normality for the dichotomous variable is that of having equal probabilities for each category (Nunnally 1967, McNemar 1969).

2. Partial and multiple correlation

Pearson's r is a measure of simple correlation between two variables, but extensions of it manipulate more than two variables at the same time.

a) Given a simple correlation between two variables, then the influence of a third, or of a third and fourth etc., can be subtracted from it to leave a correlation between the two variables independent of the other influence. This is known as partialling and the partial r is represented as $r_{12.3}$ or $r_{12.34}$ etc., meaning that the r value is given for 1 and 2 with the variance due to 3, or 3 and 4 etc. subtracted (or 'partialled out'). An assumption in using the partial correlation is that each pair of variables is bivariate-normal. Another assumption is that the variable(s) to be partialled out have a one-way casual influence upon the relationship between the first pair, otherwise there would be little purpose in partialling out their variance.

Partialling is used where it is possible to obtain correlations between a number of measures, but where it is not possible (either experimentally or by other means) to separate out the effects of each variable. Certain limiting assumptions must be made about directional relationships, and the effects of these presumed relationships can then be analysed using the partial r method. The coefficient obtained is that between two variables when a third variable is held constant. This method has obvious advantages when using interval-scale data from political and social systems, being a major way of separating out various influences.

b) Whilst partialling separates out the influences of other variables upon a pair relationship, multiple correlation gives a measure of the combined influence of a number of variables in accounting for a single dependent variable. The coefficient is represented by R, and the variables by $R_{1.23}$, meaning here that variables 2 and 3 have been correlated jointly with the variable 1, the dependent variable. If a political variable is 'caused' by a number of social or economic variables, then these can be used co-jointly to predict the political variable. A form of partialling occurs between the independent variables so that any overlapping variance within their set is not duplicated in the prediction. Thus independent variables with low correlations between themselves, yet medium correlations with the dependent variable would behave additively in explaining the variance of the dependent variable, whilst the use of independent variables with high intercorrelations would be inefficient because of the duplication..

3. Regression transformation

The values obtained from a regression transformation are commonly known as residuals, and less commonly as delta scores. Given two linearly correlated variables, then the variance of one can be subtracted from the variance of the other to leave a residual distribution of values. This is useful where the individual residual values are required, e.g. for a mapping of the residual distribution, or for further use in statistical analysis.

If the variance of a third variable is subtracted individually from two others, and the residual values for these two are then correlated, the result is identical to that from the partial correlation $r_{12.3}$.

The formula for obtaining the residuals, or delta scores, from simple regression is :

$$\delta = \frac{z_1 - r_{12} z_2}{\sqrt{1 - r_{12}^2}}$$

where z_1 and z_2 are the standard score values for variables

1 and 2, and r_{12} is the simple correlation between variables 1 and 2. The value $r_{12}z_2$ is the regression estimate of z_1, and so the numerator is an observed value minus estimated value difference. The denominator is the standard error of estimate, and is used to standardise the scores, which have a mean of zero and a standard deviation of one (Ferguson, 1966).

The scores can be used if the variance of one variable is to be subtracted from another so that there is no correlation between the residual and the variable subtracted. Obtaining standard scores and then simply subtracting does not give this zero correlation.

4. Index correlation

Assuming that no variable exists in complete isolation and independence from some other variables, then the way in which the variable is measured is important. The variable is a theoretical construct which we wish to operationally define and measure. Different ways of measurement may include or exclude the influence of some other related construct, and so give rise to different degrees of correlation with other phenomena.

One decision in measurement is in whether or not to use absolute values, or to use these in ratios to obtain index values. When absolute values are used, there is an assumption that the units from which they are taken are 'equivalent' - that they are equal in all respects pertaining to influence upon the measurement. When they are not equivalent, then the absolute measurements are contaminated, and this contamination or confounding must be controlled for. Most often with irregular sized units, size itself is the variable to be controlled for, and the use of ratios of absolute measurements will control for the size differences as such.

Given both absolute measures and indices, then a 'spurious' correlation could result if one measure was used when the other measure was appropriate. Pearson (1897) first showed that the use of indices gives a spurious correlation when absolute measures should be used, and

Yule (1910) showed the converse, that the use of absolute measures gives a spurious correlation when indices should be used (see also Brown et al 1914, Yule and Kendall 1948, McNemar 1967).

It became apparent that the choice of indices or absolute measures in correlation depends upon assumptions of the causal processes influencing the units under study. Because each unit is assumed to be equivalent in correlation, it follows that knowledge of causation is required in order to assess this equivalence. For instance, the question might be phrased as 'what causes the units to be equal?', and the answer would refer to experimental or observational design, and to the relevance of defined aspects of the unit to the relations under study.

To illustrate, measurements based upon either organisms or areal units of unequal size have at least two components, (i) relative size - measurement x in relation to measurement y for unit A, (ii) absolute size - the absolute value of x or y. If one theorised that the size of a country partially accounted for its population size (or vice versa), and therefore for a measure of political power, then the use of these absolute measures in correlation would be justified in a study of internation relations. If, however, one theorised that certain combinations of income per capita and urbanisation per capita caused variations in the crime rate, then the use of ratios in correlation is required. The three cases defined by Yule (1910), which relate causal processes to measurement form, are applied to electoral statistics below:

a) Causes influence absolute magnitudes.

There are probably no cases where the absolute magnitudes only of electoral statistics can be related with profit. The size of the electorates confounds the relation between voting behaviour and other variables.

On the other hand, absolute enrolment size may be compared to the percentage party vote (but not the absolute vote) if one is theorising about the influence of gerrymandering or spatial city growth upon the party voting

strength. For either gerrymandering or for city growth, a definative causal process relates electorate size to the percentage party vote.

b) Causes influence ratios, or the way of combining ratios.

i) Most correlations of electoral behaviour use indices, e.g. ALP supporters as a percentage of formal voters, perhaps correlated with persons of 21-25 yrs of age as a percentage of persons over 21 yrs of age. The relationship is explicitly between proportions, the absolute size of the electorate not being directly important to the relationship. The equivalence of the electorates can be created mathematically and has two components. Firstly ratios are obtained, controlling for size differences. Secondly size is partialled out of the correlation, controlling for unequal size sampling of the study area.

The latter is used when inference requires that the sampled units are equivalent. For instance growing cities often show a concentrically patterned increase of electorate size with distance from the city centre, and this gives a systematic sample bias to the study. Partialling of absolute size would give an adequate statistical control except that electorate and population size are logically and sociologically related to population migration and density. Unfortunately the degree to which population density is an intervening-type variable will be unknown. At the best this technique works by negative exclusion - if the change between the simple and partial coefficients is slight, size bias in sampling has little effect. If the change looks significant however, it may be due to population density intervening. Some other techniques of accounting for bias is really needed; size sampling, population density, and the concentricity of variables for this study are linked in causal ways probably non-separable by partialling techniques.

ii) Figure 3 shows the nested form of electoral statistics, giving the ratio forms used in this study. Although the absolute numbers of non-participants reduces the possible absolute number of informal voters, the proportions of participators and informal voters are sociologically independent for purposes of comparison.

The causes leading to the given proportions are to be investigated, and nesting is one such cause only so much as the nesting is caused sociologically: it is cause x which causes some people not to vote, and cause y which causes others to vote informal. Causes x and y may each be multiple, and they may be related sociologically, but this must be analysed in sociological terms - there is no spurious index correlation.

c) No knowledge of causes.

Should there be no knowledge of causation, then the use of either index or absolute values can be inappropriate.

In summary, the types of correlation coefficient are summarised below, for absolute and index, simple and partial correlation. The formulae for absolute and for index correlations are different, but similarities regarding the partial formulae can be derived if the third and fourth moment terms, skew and kurtosis, are left out of the index formulae; the latter then assume perfect normality (Brown et al 1914, Pearson 1897).

(1) r_{xy} , the simple r between the absolute values of x and y.

(2) $r_{\frac{x}{z}\,\frac{y}{z}}$, the simple r between the indices of x and y, each divided by z.

(3) $r_{xy.z}$, the partial r between x and y with z partialled out.

(4) $r_{\frac{x}{z}\,\frac{y}{z}.z}$, the partial r between the indices with z partialled out.

If all the absolute and index values were multinormal (all pairs were bivariate normal), then (3) would equal (4). This is rarely the case, and so substitution is to be avoided. Most frequently (4) is the most stable coefficient, being less prone to influence by a solitary extreme value. However with the correlation of spatial aggregates, (2) is often a good estimate of (4) (Brown et al 1914).

One attempt in this study to control for the sampling bias of size used (4), though most indices were of type (2).

It was considered, in agreement with Brown et al, that (2) was a good estimate of (4) (see chapter 5).

5. Spatial autocorrelation or spatial dependency

There is some semantic confusion in using the term 'spatial autocorrelation' in geography which has led to some confused ideas about its importance in analysis. The term 'autocorrelation function' has a specific mathematical meaning, but the term 'autocorrelation' has been generalised by some to describe any serial dependency in the data whatsoever. Consequently three arguments are heard: the first that 'autocorrelation' should be excluded from analysis for mathematical reasons, the second that it should be included because spatial dependency is what geography is all about, and the third that it is a function with distinct analytical uses which should be used with a full knowledge of its properties.

The difference between the first two and the third arguments is of course in the semantics of the term 'autocorrelation'; the first two are concerned with dependency and the third with the specific function (see below).

The difference between the first and the second arguments is one of method in relation to purpose. The wrongly used term 'auto-correlation' directly introduces some verbal confounding here, for arguments for or against excluding 'autocorrelation' are really about 'dependency' and originally assumed that inferential correlation methods were being used in analysis. Inferential correlation requires the independence of observations, and for nonrandom spatial patterns the value of one unit is dependent to some degree upon the values of adjacent units. However descriptive correlation, and some types of inferential method (such as spectral analysis) do not require independence.

To generalise, any inferential method requiring independently obtained observations cannot be used with nonrandom spatial series because of the spatial dependency (unless the dependency is somehow accounted for). The term 'spatial dependency' used in this context is much less confusing than the term 'spatial autocorrelation'.

It followsthat there can be no use of significance tests with r for spatial patterns; Curry (1966) uses the example of spectral analysis simply to stress that the r between two space series will not be 'significantly different' if different sized areal units are used to measure the series. The previous consideration of 'sample or population' is now irrelavent if inferential r cannot be used.

An example of spatial dependency: given a diffusion pattern, then taking a transect through the origin and taking the differences between each point and every other point on that transect and then averaging the differences for each distance class will give an exponential curve - values are similar close to a point and dissimilar further off from the point. This curve could be called an autocorrelation curve but is more appropriately called a dependency curve. It illustrates the nonrandom nature of the point pattern for the values for specific variables.

In principle the theory and mathematics of autocorrelation functions for time series (e.g. Bendat and Piersol 1966, Wiener 1949) could be employed for an analysis of space series by extending to two dimensions (e.g. Tobler 1966). A time series autocorrelation function provides information on the influence (vice versa dependence) of values at any time upon values at a later time according to certain specified forms (e.g. sine wave). The utility of the autocorrelation function is that it eliminates random noise from any periodic deterministic regularities, enabling a straightforward use of power spectral density analysis to estimate the frequency composition of data as an analysis of the (areal) system (Bendat and Piersol 1966, Wiener 1949, Tobler 1966).

Inferential correlation cannot logically be used for spatial patterns, but if inference in relation to a problem of this type is required, then the power spectral density function derived via an autocorrelation function can be used for analysis. It is limited to the analysis of periodic regularities, aperiodic autocorrelation being more difficult to analyse. These types of method were beyond the author at the time of writing.

The importance of the foregoing discussion is that r can only be used descriptively in this thesis. However there is still no aljebraic or numeric exposition of all the implications of spatial dependency for r, and so allowances are made for the improbable but unknown, i.e. for the chance that the dependence effect is still numerically acceptable. Because of the latter possibility, significance tests are sometimes used as intuitive guides, though there is always a danger that a false sense of confidence might result from their use.

6. Slopes versus correlations

The correlation coefficient r measures the degree of relationship between two variables in terms of the variation accounted for, and therefore gives an estimate of the accuracy of the regression slope.

The regression coefficients[1] describe the nature of the relationship and therefore give the laws of science (Blalock 1961, p.50-52).

Blalock gives a number of instances where r is of greater interest than the regression coefficients:

(i) in partial correlation, where r is expected to be reduced to zero,

(ii) when assessing the relative importance of different variables in situations involving actual changes,

(iii) where measurement is crude and where the main concern is to identify variables of importance.

This study uses partial correlation, and is concerned with the relative importance of different variables in city subregions. The main concern is with identifying the

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1. For the regression equation $Y = a + bX$, then a and b are the regression coefficients, a being a constant and b being the measure of slope.

importance of different variables; replication is tied to scale and city sample and so the regression coefficients are of much less importance than r for the entire study.

CHAPTER IV

VOTING VARIABLES

The three main types of voting behaviour, %ALP vote, participation (turnout), and the informal vote can be affected by the type of electoral system as well as by social factors, and so a detailing of the system type and influence follows.

1. Electoral system type

Whilst the system type itself is a variable for analysis between countries, within most countries it is a 'global attribute' affecting all areas equally. This is so for Federal elections in Australia, and whilst the country is divided into states, and these into local government areas (with each having its own elections and constituency boundaries) the Federal electoral laws for the Commonwealth of Australia are uniform within the country. The franchise is given to all British Subjects or naturalised Australians over 21 yrs of age, with some minor exceptions such as some people in mental asylums and prisons. A striking feature of the Australian system is that both enrolment and voting is compulsory, and while this has obvious implications for the size of the turnout at an election, it has less obvious implications for both the influence upon party vote, or for the makeup of and relation between the informal vote and the turnout.

With compulsory enrolment there is an almost total sample of elegible electors on the electoral rolls, and with compulsory voting there is an almost total allocation of ballot papers to this sample. What this might mean in terms of political apathy or experience is not known, though the implications are discussed in chapter 6. In contrast to a system with non-compulsory voting there would be fewer non-participants staying away in protest or apathy, though more of the informal vote would be a protest vote (against either main party, or against voting). Yet having been forced to vote, most electors choose to use their ballot paper formally.

Figures for the House of Representatives election have been used; for this House a single member is elected for each electoral division (constituency) by preferential voting. For the measure of the percentage of party vote in this study, first preferences only were used; because the number of candidates can split the first preferences, then any systematic variation of the number of candidates with a party's first preference vote should be investigated, and is done so for the ALP below.

Australia has basically a two party system, yet there are two other smaller parties which traditionally group with one of these. The ALP is the largest single party in terms of its electoral support, and could be described as 'left wing' or moderately socialist. The Liberal Party is its major opponent and is 'right wing' or conservative. The remaining two significant parties are the Country Party (not present in cities) and the Democratic Labor Party, which usually give their preferences to the Liberal Party; the remaining Communists, independents, and others are of insignificant numbers. It is therefore logical, and an accepted practice in the analysis of Australian politics, to use the 'ALP versus the rest' if a dichotomy is needed. Taking the %ALP first preferences gives one such dichotomy: a left/right wing or socialist/conservative division, which has a meaning beyond the party label, which taps one of the basic dimensions of Australian society.

2. Main measures, and others

For party preference the %ALP first preferences were used. These were taken as a percentage of all formal votes.

Participation was taken as the percentage of electors to whom ballot papers were issued to the number of electors enrolled, and was taken straight from the Electoral Returns.

The informal vote was measured as the percentage of informal ballot papers to the number of ballot papers issued (i.e. to the number of participants).

After the initial decision to use %ALP, %participation, and %informal vote as the primary dependent variables, there remain a number of secondary political variables to be assessed for their influence upon any derived relationships.

In particular these are the number of candidates per electorate, the safety of a seat, and the donkey vote. Other less easily quantifiable variables such as the regional variation in perception of policy and issues, or the impact of personalities upon the local electorate, have been ignored although they will presumably add to the unexplained variance of any model developed.

The unwanted influence of any variable can be removed from a dependent variable by regression transformation. New values are thus created for the electorates, and these values then correlate zero with the unwanted variable. A consideration of these unwanted influences follows, and rationales are given for accepting or rejecting that they have a causal influence, and if influence is accepted, for transforming their effect out of the analysis.

One other type of variable is considered, and this is within-division areal variability of the ALP vote and participation. High or low regional variation within an electorate could have implications for methodology, inferences, and theory, and so it is considered in relation to parts of the main analysis.

3. Number of candidates

a) Informal vote

The Current Affairs Bulletin (vol 43, no.10, 1969) states that

> the proportion of informal votes rises on average by between one-quarter and one-half of one percent with each additional candidate offering for a single member constituency (p.158).

The primary interest is therefore in excluding the effect of the number of candidates from the percentage informal vote, and this can be done either by subtracting say $\frac{1}{4}\%$ for each candidate from the total percentage informal vote, or by using the regression transformation.

Both methods were used but the subsequent correlations of the residuals with other variables showed practically no variation and so the regression transformation was used in analyses. For example in Sydney the correlation between the %ALP vote and the informal vote residual was r = .606 whilst that between %ALP and the informal vote with percentage correction (and $\log_{10}$ transform) was r = .597.

The frequency distribution for the number of candidates was skewed towards the few electoral divisions with large numbers of candidates, and so log transforms were applied to these distributions for both Sydney and Melbourne. Some slight skew remained but it was considered to be within the limits of applicability (Nunnally 1967, p.125-6).

In Sydney the correlation between the informal vote and the number of candidates (with log transform) was r = .225, and in Melbourne, with the informal vote also having a log transform, the correlation was r = .398. Because of the smallness of the correlations, only a small amount of variance is being removed from the informal vote percentage by the regression transformation, and this corresponds to the small amount indicated by the Current Affairs Bulletin.

The more candidates there are then the more error is made on the preferential-type ballot paper, and therefore the higher the informal vote. Consequently the informal vote used in analysis is always that with the variance of the number of candidates removed.

b) Participation and %ALP vote

The number of candidates also has a correlation of r = .217 in Sydney and r = .068 in Melbourne with percentage participation, but it is difficult to see how the number of candidates could cause variation in participation, and so this was ignored.

The %ALP vote correlates with the number of candidates to the degree of r = -.522 in Sydney and r = -.004 in Melbourne, and whilst Melbourne can be ignored, there is the possibility that in Sydney the number of candidates

could split the first preferences and therefore lower the %ALP vote. For this reason the relationship in Sydney is examined below.

c) %ALP and number of candidates in Sydney

Comparing figures for 1961 and 1966, the number of candidates in 1961 do not correlate with %ALP in either 1961 or 1966 ($r = -.06$ and $-.01$ respectively), but the number of candidates in 1966 correlates with %ALP in both 1961 and 1966 ($r = -.42$ and $-.52$ respectively). The problem of correlation and causality is such that it is not known if the latter correlations are sheerly random, or, if there is an influence, in what direction and to what degree it is.

It is obvious that the number of candidates in 1966 did not cause variation in the ALP vote in 1961, but it is possible that the ALP vote in 1961 stimulated the particular distribution of candidates in 1966. If the latter is so, then this distribution may or may not have reduced the %ALP figures by splitting the first preference vote where there were many candidates.

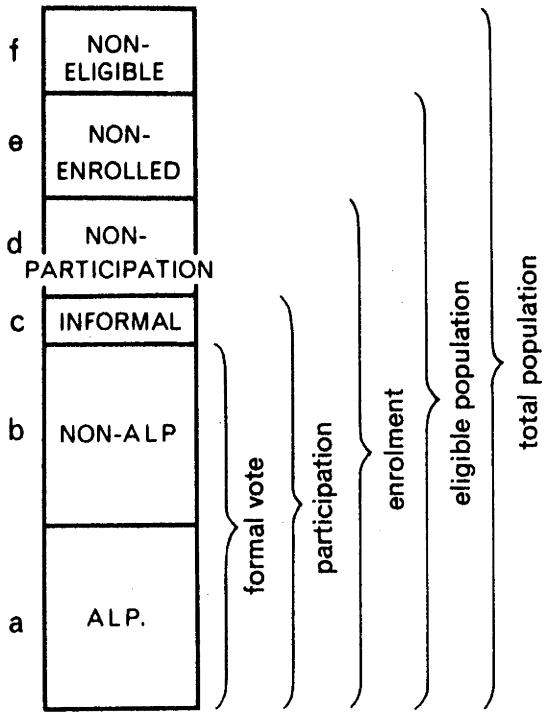
A possible rationale for this development would be that the near-ALP victory in 1961 stimulated greater opposition in 1966, and then in taking into account the expected swing against the ALP in 1966, (i) ALP-held marginal seats would be more likely to be won by the non-ALP if few candidates stood - in order to maximise the effect of the swing, (ii) non-ALP-held marginal seats would be expected to increase their non-ALP vote, and because safe seats do not usually attract many candidates, these seats would be the ones most likely to attract the larger number of candidates and to share their votes more among these.

Of course other factors will be important in some cases, e.g. the death of the member for North Sydney presumably contributed to the large number of candidates there, and the peripherality and rapid growth of Mitchell, plus the presence of an air force base probably stimulated the larger number of candidates there (quite a few candidates were connected with the air force).

Not only does the number of candidates in 1966 correlate with %ALP in 1961 and 1966, but it correlates r = .46 with the independent decrease in the ALP vote between elections (i.e. with the residual from the between-elections correlation). These figures establish that (i) there were more candidates in 1966 in traditionally non-ALP voting areas, (ii) there were more candidates where there was a beyond average decrease in the ALP first preference vote.

Whilst the association of more candidates with non-ALP areas, and with areas where there was a greater decrease in the ALP first preference vote is known, the degree of contribution of the number of candidates to the ALP first preference totals remains unknown. Random association, dependent association, and some small systematic causal effect could be expected, but if the latter were numerically insignificant, then partialling the candidate variance from the %ALP vote would give an invalid result in terms of accuracy of the ALP distribution. Two considerations led to the rejection of the idea of taking out the variance of the number of candidates.

Firstly the range of the effect is limited. A comparison of the numbers of candidates with those divisions which swung most and those which swung least from the ALP is given in table 1. Expressing the swing in vote in standard scores, then the above average swing has a negative sign, and the below average swing has a positive sign; the highest negative score indicates maximum swing and the highest positive score indicates minimum swing. In table 1 values for the nine largest absolute scores are given for comparison.



enrolment (1) = $\frac{d}{f}$

enrolment (2) = $\frac{d}{e}$

participation = $\frac{c}{d}$

informal vote = $\frac{c-b}{c}$

ALP vote = $\frac{a}{b}$

Indices used

Figure 3 Nesting of voting variables

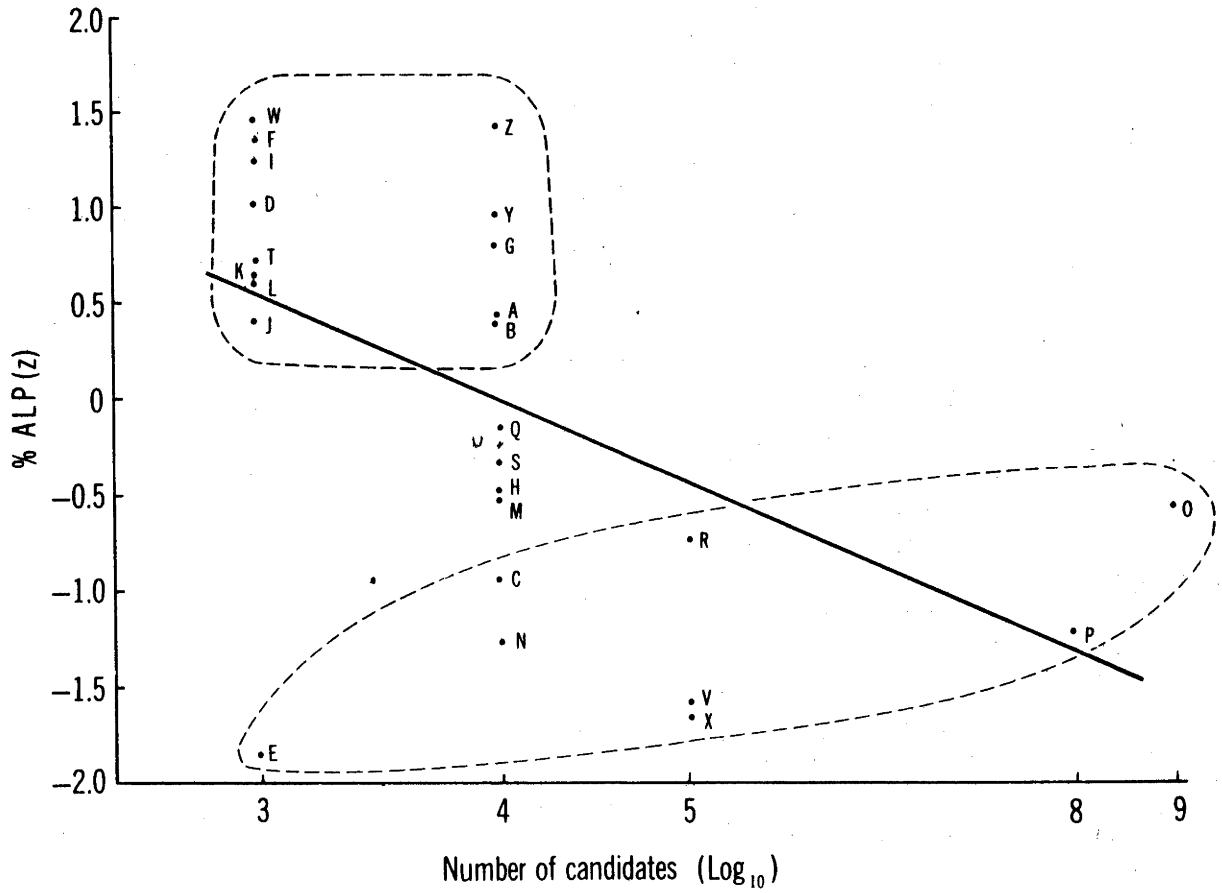


Figure 4 % ALP and number of candidates in Sydney

Letter	Division	Swing	Number of Candidates 1961	1966	Difference
C	Bennelong	-2.250	3	4	+1
O	Mitchell	-1.857	4	9	+5
P	North Sydney	-1.525	3	8	+5
U	St George	-1.140	3	4	+1
W	Watson	-1.101	3	3	0
K	Kingsford-Smith	1.535	3	3	0
V	Warringah	1.527	5	5	0
I	Grayndler	1.329	4	3	-1
Z	West Sydney	1.279	4	4	0

Table 1. Swinging vote and the number of candidates

Any partialling of the number of candidates from the ALP vote would greatly affect Mitchell and North Sydney by increasing their %ALP vote and therefore lowering their swing. Only minor changes would be expected for the others. There is just not enough information to validify using the regression transformation if these two electorates are going to absorb most of the change. The causal mechanisms relating the large number of candidates to the %ALP vote in the two electorates are unknown.

Secondly, the regression plot of %ALP upon the log of the number of candidates (figure 4) shows a distribution which can be interpreted in at least two ways as follows:

(i) the nine seats with only three candidates and the five seats with more than four candidates are separated on the %ALP axis, with the exception of E (Bradfield, which has the lowest ALP vote). The two seats with the very large number of candidates are outliers in the regression space and contribute largely to the non-linearity of the pattern. If the 'exceptions' of E, O, and P were excluded, then the regression line would be much steeper. However this exclusion has no theoretical base and would therefore be artificial.

(ii) If safe seats attract few candidates, then the position of E is appropriate, though that of X is less so. However, two distinct subgroups can be seen in the plot. The high %ALP seats form a square in the upper left corner,

whilst the low %ALP seats have a more diffuse, elongated grouping in the lower half of the plot. They are joined by a single line of intermediate %ALP seats, and depending on whether these are included in one group or the other, the relative regression slopes of the two groups are either horizontal or in opposite directions.

The joint effect of the two distributions is to locate the higher number of candidates in the middle and lower-middle part of the ALP axis, i.e. generally away from very safe seats, but with a bias towards low %ALP seats including those moderately safe.

Given the existence of the two sub-populations, then partialling the number of candidates from %ALP upon the basis of a single regression line would most likely introduce greater error than if the ALP distribution was left unaltered.

For these reasons the %ALP vote was left unchanged.

4. Seat safety

Prescott (1969) asserts that "turnout is vitally affected by the extent to which a seat is considered 'safe' or 'marginal'" (p.381) upon the basis of Butler's 1952 British election study. There is compulsory voting in Australia, yet relations similar to those in England might still be operating.

a) safe seat measure

In order to quantify the relationship, a measure of the safety of a seat is needed, and it is particularly fortunate here that the %ALP frequency polygons for both Sydney and Melbourne are grossly normal but bimodal. Seat 'safety' means a long-term pattern of very high ALP or non-ALP vote, and whilst there will be minor variations between elections, the pattern for one election will be similar to that for a later election. Thus the pattern of very high or low ALP vote in 1966 would be a good estimate of the safety of the seats in the city. Thus an adequate measure of the safety of a seat would be the extremity score for the 1966 %ALP vote. If all the ALP percentages are transformed to absolute standard scores,

i.e. the sign is ignored, then the resulting distribution is one of the estimate of the safety of a seat, the higher the score, the safer the seat. The original frequency distributions are fortunately patterned because the gross normality allows for the usual interpretation of a standard score, whilst the bimodality means that the distribution of the absolute value of the standard score is also approximately normal, and so can be used directly in correlation (see figs. 7a and 8a for the %ALP distributions).

b) seat safety and %ALP and the informal vote

Seat safety correlates with the informal vote in both Sydney and Melbourne ($r = .237$ and $.257$ respectively) but the contribution of seat safety to the informal vote is probably very insignificant; electors in safe seats may feel freer to be humorous or otherwise protest with their ballot papers, but there is no known direct and significant effect. Similarly %ALP correlates with seat safety ($r = -.175$ in Sydney and $r = .238$ in Melbourne) but as one is the transform of the other, the further regression transformation cannot be used.

c) seat safety and participation

The variance of seat safety was not subtracted from the participation measure, but the rationale for this is given in chapter 7, where it is analysed in conjunction with city centrality.

5. The donkey vote

In every election a small percentage of voters number their ballot papers straight down from top to bottom. This vote, termed the 'donkey vote', gives a small advantage in terms of first preferences to the candidate at the top of the ballot paper.

Whilst the effect of the donkey vote should be considered, this study concludes that estimating it involves too many uncertainties and is not worth the effort. Only four ALP candidates in Sydney and six in Melbourne headed the ballot paper, but even so some small influence in the overall pattern of the ALP vote is possible.

a) donkey vote estimate

An analysis is given using Sydney figures only, and in 1966 the best way to estimate the donkey vote there was to use DLP[1] figures. Of the 26 electorates (all of which were won by either the ALP or the Liberals), in 14 cases the DLP candidate headed the ballot paper. The average %DLP first preferences in these 14 seats is 2.37 percentage points higher than that in the remaining 12 seats (see tables 2a and 2b), and this difference is the first approximation of the donkey vote estimate.

Party	Electorates
ALP	4
Liberal	3
DLP	14
Other	5

Table 2a. First position on the ballot paper

Place	Percentage
First on ballot paper	6.19%
Other place	3.82%
Difference	2.37%

Table 2b. Mean percentages of DLP first preferences by ballot position

	DLP ballot position		
	First	Other	Total
ALP	8	3	11
Liberal	6	9	15
Total	14	12	26

Table 2c. DLP ballot position and party seat

Two other sources could contribute to the 2.37% difference, and these are (i) an underlying social correspondence with the distribution of DLP first positions on the ballot paper, and (ii) variation in the number of candidates contributing to variation in the DLP first preference percentages.

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[1]. DLP = Democratic Labor Party.

Candidates	DLP 1st	DLP other	ALP	Liberal
3	5	4	7(3.8)	2(5.2)
4	6	6	4(5)	8 (7)
5	2	1	0(1.3)	3(1.7)
8	1	0	0	1
9	0	1	0	1
Total:	14	12	11	15

Table 3a. Candidates with DLP place and party seat, separately*

	DLP first place		DLP other place	
Candidates	ALP	Liberal	ALP	Liberal
3	5 (3.9)	0 (1.1)	2 (3.1)	2 (0.9)
4	3 (2)	3 (4)	1 (2)	5 (4)
5	0	2	0	1
8	0	1	0	1
9	0	0	0	0
Total:	8	6	3	9

Table 3b. Candidates with DLP place and party seat, combined**

* figures in brackets are expected frequencies based upon the total seats won by the ALP or Liberals.

** figures in brackets are expected frequencies based upon the ALP and Liberal figures for the appropriate row of candidates in table 3a.

Table 2c shows more DLP candidates heading the ballot paper where the ALP won seats, and more being in other places where the Liberals won seats. The point-biserial correlation between the DLP first place on the ballot paper and the %ALP vote is $r_{pb} = .22$, and so, if what contributes to the ALP vote also contributes to the DLP vote, then a very slight proportion of the 2.37% difference could be due to social influence as represented by the ALP vote.

Table 3a shows an equal distribution of the number of candidates with the DLP first placing (r_{pb} = -.02), and also shows the bias towards few candidates in ALP seats. When the analysis of the DLP position is combined with party seat (table 3b), the DLP candidate is seen to head the ballot paper more often than expected in ALP seats with few candidates. Thus although there is no correlation between the number of candidates and the DLP first place, the number of candidates must be accounted for in combination with %ALP when using the %DLP vote to estimate the donkey vote.

The estimate is analysed as follows:

(i) The DLP first places are located slightly more where the ALP has a high vote and where there are fewer candidates. Therefore the DLP first place vote difference could be slightly inflated by the influence of common sociological origins, or by the fewer numbers of candidates allowing a higher average first preference vote for all candidates.

(ii) For there to be a sociological effect, a sizeable correlation between the %ALP and %DLP votes would be expected after both the numbers of candidates and ballot position have been controlled for. The simple correlation of r = .33 between %ALP and %DLP is reduced to r = .21 when candidates is partialled out alone, to r =.25 when DLP first place is partialled out alone, and to r = .07 when both together are partialled. Thus the correlation could be explained by ballot technicalities rather than by social effects, though a detailed knowledge of causation remains unknown.

Although %ALP has been used, similar results are obtained when socio-economic status is used. The correlations between socio-economic status (the measure is detailed in chapter 5) and each of %ALP, %DLP first place, and the number of candidates are r = .91, .27, and -.44 respectively. Socio-economic status and %DLP correlates r = .35, but when the variance of either the number of candidates or first place alone is subtracted from %DLP, the correlation becomes r = .23 in both cases. When the

combined variance of both the number of candidates and first place is subtracted from either %DLP alone by semi-partial correlation[2], or from both %DLP and socio-economic status by partial correlation, their correlation is reduced from r = .33 to r = .08 in both cases. Thus the relationship between %DLP and socio-economic status could also be explained by ballot technicalities.

(iii) Although there is a small correlation between the number of candidates and socio-economic status, and between the number of candidates and %DLP, the possible line of influence, socio-economic status → %ALP → number of candidates → %DLP is made further doubtful or complex because the correlation between the number of candidates and %DLP remains when both DLP first place and %ALP are partialled out. It is reduced from r = -.30 to r = -.16 when %ALP is partialled, it is increased from r = -.30 to r = -.38 when first place is partialled, and it remains at r = -.30 when both are partialled.

It appears that there is some variance between %DLP and the DLP first place which is not related to the number of candidates, but which slightly suppresses the simple correlation between the number of candidates and %DLP. This 'real' correlation becomes r = -.30 when %ALP is independently semi-partialled out.

This is expressed differently by a multiple correlation which used semipartial coefficients (to remove the variance of DLP first place from simple r coefficients). The simple correlation between %DLP and the number of candidates is r = -.38, whilst the multiple correlation (always positive) which includes %ALP is also R = .38. Thus with first place held constant, %ALP does not add to the number of candidates in predicting %DLP.

(iv) It appears likely that the number of candidates but not %ALP could contribute to a higher %DLP vote where the DLP heads the ballot paper, but a minimum estimate could

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2. Semi-partial correlation is represented by $r_{1(2.3)}$, meaning that the variance of 3 is subtracted from 2 but not from 1, i.e. 3 causally contributes to 2 but not to 1.

be obtained by excluding the variance of both. A most likely estimate would exclude the variance of the number of candidates only.

To do this an assumption has been made that a new mean and standard deviation can be obtained for the transformed distribution, and that specific values can be reconstructed from the standard-score type residuals. It has been assumed that both the mean ($\bar{x}$) and variance (S^2), as they are here for ratio-scale measurements, are reduced inversely in proportion to the square of the r coefficient (working arithmetically in variance), so that where Y = %DLP,

$$\text{Residual } \bar{x} = \bar{x}_y (1 - r^2)$$

$$\text{Residual } S^2 = S^2_y (1 - r^2).$$

These values are then substituted into the standard score formula so that where x is the specific percentage value wanted, and δ is the standard residual score,

$$x = \bar{x} + \delta S$$

The new percentage values can then be summed for the DLP first place/other place dichotomy and the difference in means obtained.

(v) For this method the most likely estimate uses r = -.30, and using this the %DLP mean is reduced from 5.093% to 4.635% and the variance from 1.865% to 1.779%. The recalculated donkey vote estimate drops from 2.37% to 2.35% only, as expected.

Calculating the minimum estimate requires using a multiple regression transformation, which for two independent variables is given by

$$\delta = \frac{z_1 - (\beta_2 z_2 + \beta_3 z_3)}{\sqrt{1 - R^2}}$$

where β_2 is the beta weight for the standard score of variable 2, and is defined by

$$\beta_2 = \frac{r_{12} - r_{13} r_{23}}{1 - r^2_{23}}$$

and similarly,

$$\beta_3 = \frac{r_{13} - r_{12}r_{23}}{1 - r_{23}^2}$$

and where R is the multiple correlation coefficient. The values for these delta scores are then treated identically to those in section (iv).

The minimum estimate uses the multiple regression transformation with R = .362 (i.e. when number of candidates and %ALP predict %DLP with first place not held constant). For number of candidates $\beta_2 = -.139$, and for %ALP $\beta_3 = .235$. The recalculated donkey vote estimate was 2.161%.

(vi) The effect of partialling out number of candidates only using the method above with r = -.30 gives the following approximate changes in the %DLP vote:

Candidates	Approx. change
3	reduction of 1% in DLP first preference vote
4	reduction of 0.5% " " " "
5	no change
8 or 9	increase of 1% " " " " "

(vii) To summarise, the bias contributing to the donkey vote estimate can be specified within limits. Given the operationally closed system of a limited number of variables plus a limited number of allowable relations, then a maximum, a minimum, and a most likely estimate are deduceable. In this case the maximum estimate is 2.37%, the minimum is 2.16%, and the most likely estimate is 2.35%. Whilst these calculations illustrate the difficulty in estimating the donkey vote, and in particular the biases involved in using DLP figures, the following section illustrates the uselessness of the estimate for the %ALP vote.

b) usefullness of the estimate

The effect of the donkey vote adjustment would be smallest for the two major parties, adding little to their percentage totals. To adjust the percentages, 2.35% could be subtracted from the four ALP first place percentages,

then all percentages could be recalculated on a base of 97.65 and not 100. This would allow for the donkey vote in all seats.

As a result, 22 ALP percentages would rise slightly, and 4 would fall slightly, with an average change of about 1% change. For example the ALP vote in Barton would change from 46.89% to 48.02%, in Kingsford-Smith from 50.46% to 49.27%, and in Bradfield from 15.38% to 13.34%.

The 4 seats where the ALP candidate headed the ballot paper are randomly distributed in relation to ALP vote, as follows:

Blaxland	(55.84%)	Kingsford-Smith	(50.46%)
Bradfield	(15.38%)	Lowe	(34.37%)

Whilst little change can be expected in using the estimate, there are other drawbacks in its use in that (i) it is based upon DLP figures, and any bias for ALP figures is really unknown, (ii) more importantly, the estimate is only an average with no frequency distribution, so that any systematic variation is unknown.

Given these uncertainties it is safer to ignore the slight variation due to the donkey vote, because adjusting for the estimate could introduce as much error as it reduces. Therefore the donkey vote was ignored in further analysis.

6. The %ALP in Melbourne

One other alteration to a dependent variable was made and this was to adjust for the effects of a split-ALP vote in the seat of Batman in Melbourne. For this seat there were two candidates associated with the ALP, one being the official ALP candidate and the other being an ex-ALP member who had left the party over the Vietnam issue. The ex-ALP member gained 22½% of the first preference votes but eventually won on preferences, whilst the official ALP candidate gained 38½% of the first preferences. Together they took 61% of the first preferences, and whilst this figure is too high to be an accurate representation of the ALP vote, the figure for the official candidate seems to be

too low. Because only one of 22 seats is affected, and because the adjustment is needed for correlation relationships and for grouping methods, then an estimate of the 'true' ALP vote was obtained by crudely splitting the difference and therefore adding 10% to the official candidates ALP vote. Although this is only an estimate, it would give slightly better correlation relationships and better ALP regional groupings.

7. Within-division variability

Measuring the areal variability of a variable within an electoral division would mean measuring pattern differentiations such as gradients or indented surfaces at a particular subscale and on particular boundaries.

The appropriateness of the subunits used is equivalent to the appropriateness of the divisional units used in sampling a pattern, i.e.whether the areal 'fit' is adequate, and whether the units are equivalent for inferences. When dealing with natural systems, the two requirements - fit and equivalence - can be incompatible unless a form of functional equivalence of units can be designed for the problem. When using official statistical units however there is usually little chance of them being functionally equivalent for a range of problems. The electoral divisions are equivalent only as units for electing members to parliament; they cannot be equally appropriate in the representation of behavioural or sociological patterns if there is a systematic variation in the type and scale of these patterns in different parts of the city. Any relationships are sample-pattern dependent, and will be perhaps less appropriate in regions where there is high variability. Further, if the units differentiate variables, say in the form of a high correlation, then the fit of the units is relatively adequate, but if the units do not differentiate, then there is uncertainty as to whether this is because of the sample fit or not.

Given this, then a measure of within division variability can still be of some help in deciding if the divisional areas are appropriate sampling units for certain methods and for some inferences. Divisions containing

high variability can be identified and related to grouping patterns, bivariate plots, and residuals, though a real variability may not always be revealed because of the pattern of sub-areas used. This gives the measure some unreliability. Nevertheless a crude measure is better than none, provided it is not completely unreliable.

a) the measure

The only supplied subgrouping of electorates are electoral subdivisions, and in 1966 there were from 8 to 19 of these per division in Sydney, and from 4 to 18 in Melbourne. They are irregular in areal size, in shape, and in enrolment size, the latter being in the order of twenty times difference (within a division) for some city-peripheral divisions. Postal, absent, and section votes are not included in the subdivision figures, but they would have little effect upon the relative variability unless some subdivisions had many old age homes, or contained a high proportion of high turnover flats (and so had comparatively inaccurate rolls).

As samples the subdivisions are very irregular, and any measure obtained from them could be only a crude and somewhat unreliable guide. The measure was computed and used mainly for its value in suggesting where patterns of variability lay, and with what they correlated.

Measures of variability were computed for the ALP vote and for participation as follows: percentages were obtained separately for each subdivision of each division, the mean and standard deviation of these were then computed for each division, and the standard deviation was then divided by the mean to give the coefficient of variation.

The coefficient of variation is a measure of comparative variability, the higher the value, the greater the variation of subdivisions within the division. The resulting pattern of values can be used in correlation and mapping to show to covariations with, and the regional distributions of within-division variability. Because there will be different magnitudes of the values for different variables, the values for %ALP and for

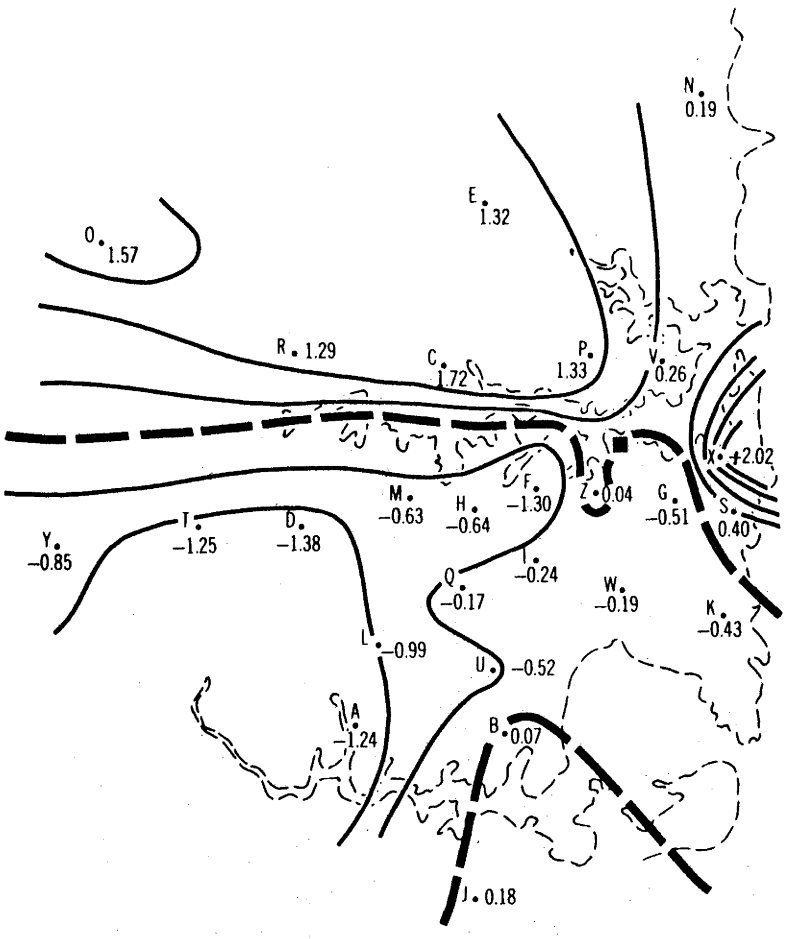

Fig. 5a. Within—division variability of % ALP

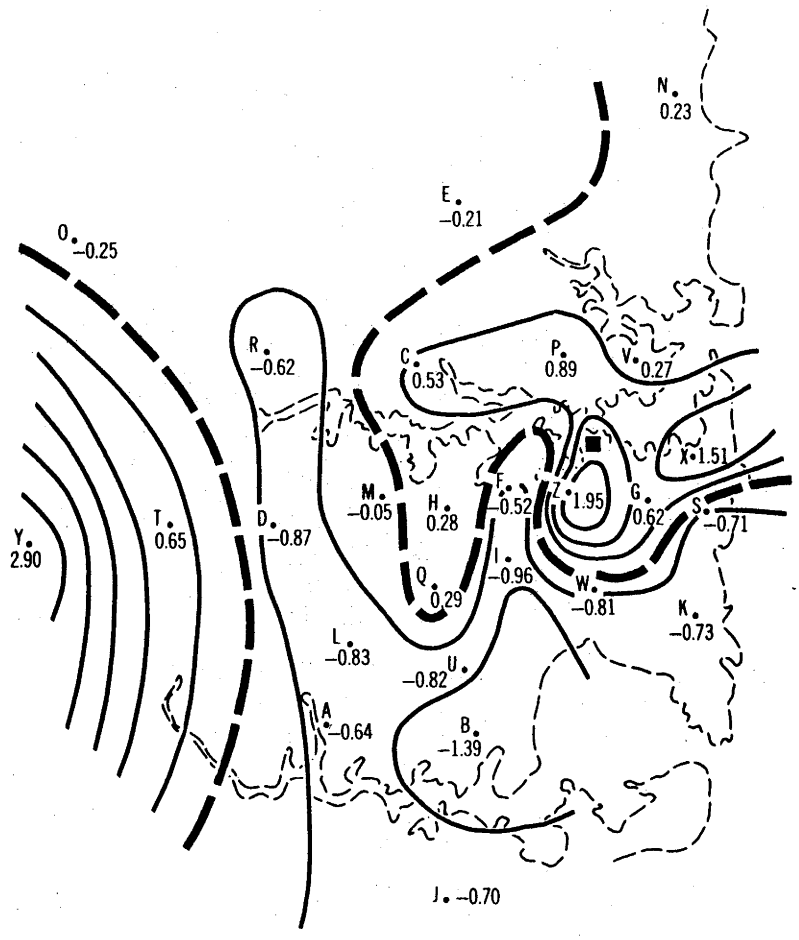

Fig. 5b. Within—division variability of participation

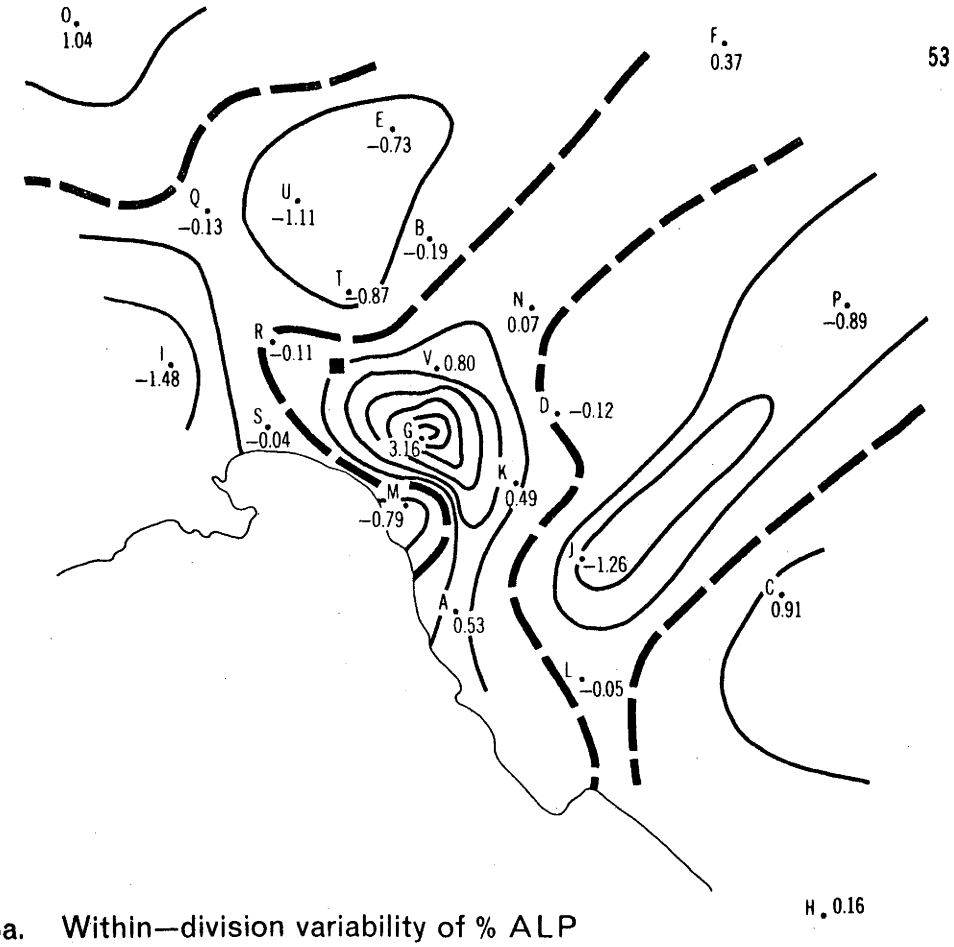

Fig. 6a. Within—division variability of % ALP

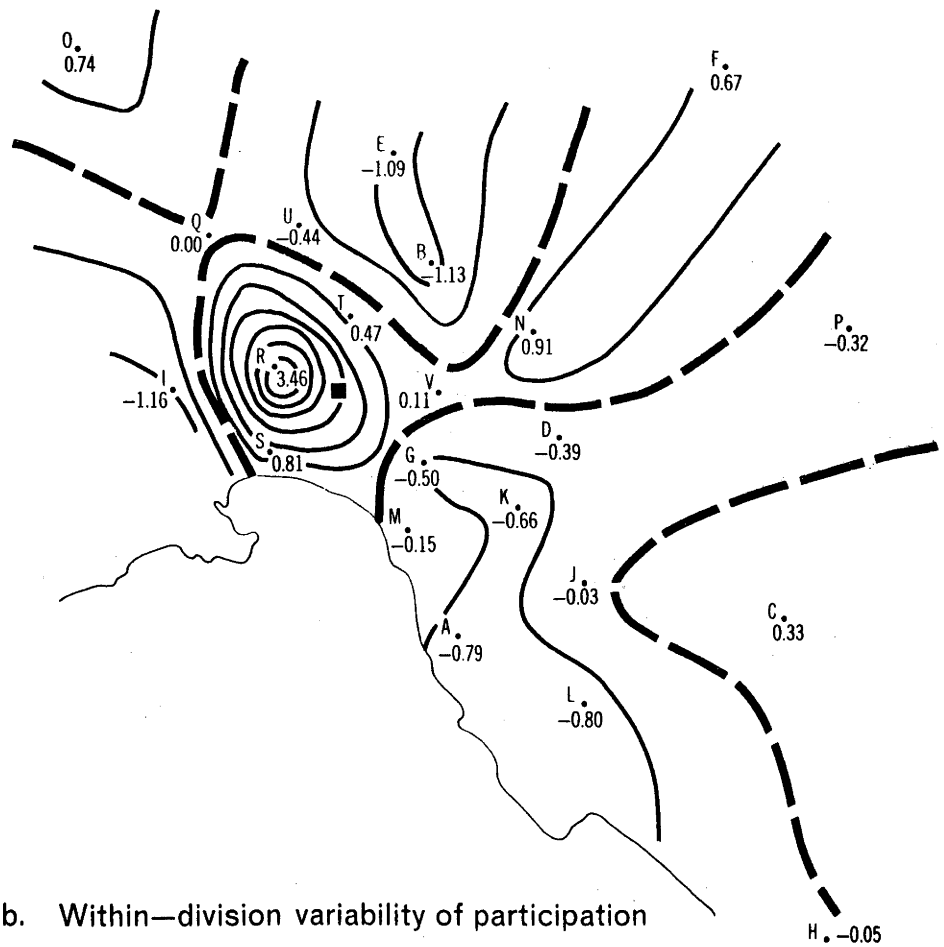

Fig. 6b. Within—division variability of participation

participation were standardised for comparability when used in mapping.

b) expected and observed variability

With areal units not greatly different in size, higher within-unit variability means a finer differentiation of areal pattern, and one would expect this mainly in the city centre area. There demographic profiles, land-rent gradients, and some voting profiles generally become steeper and contain more variability when compared to the rest of the city. Thus one would expect greater variability for %ALP and participation in the city centre area.

Comparing the variability maps for the two cities and for the two variables (figures 5 and 6) it is apparent that the inner city does generally have high variability, though it is observed in only one or two electorates there. Firstly, the pattern for Sydney appears to be much more non-random than that for Melbourne; very extreme values were recorded for single inner city electorates for both %ALP and participation in Melbourne, but this could have been partly because of the small number of subdivisions used to compute their coefficients of variation (Fawkner has 4, and Melbourne has 6). Secondly, and especially for Sydney, there are regionally systematic patterns of variability even away from the city centre, and these appear to be correlated with the distributions of the magnitudes of %ALP and participation. This warrants further investigation and is analysed in chapter 6.

c) methodological importance of within-division variability

(i) if percentages or averages are used to represent a highly variable area, they can be inaccurate summaries of the distributions and relationships between variables within the area, especially if these are skewed or otherwise non-linear.

(ii) Given a regional collection of units within which there is great variability and non-linearity of relations, then the relations among the averages for that region may not adequately reflect the areal relations of the variables within the region. If there is areal gradation of

variability, then a systematic component of error could be introduced.

(iii) Using minimum-variance grouping methods, then if the averages are inappropriate statistics, regional boundaries can be misplaced.

d) sociological importance of within-division variability

There seems to be little theory to explain or predict a regional pattern of within-division variability of voting behaviour. Consequently few relationships can be hypothesised, and where high correlations are found, their interpretation is speculative only. The variation is based upon areal units, and so is one of change in geographical gradients of the proportions of particular behaviours. Perhaps the greater geographical variability of the non-ALP vote in Sydney is a reflection of greater variability of socio-economic status between suburbs, in contrast to a more uniformly low socio-economic pattern in ALP voting suburbs. This type of explanation is deductive reasoning rather than theory building. There may be some basis of theory in Valkonen's (1969) observations on ecological variance, but this would assume different processes for the ALP and the non-ALP regions because of their different levels of variability. Behaviourally the ALP and non-ALP voters would form two separate populations - but already some indication of a dichotomy has been given (frequency polygons, figures 7 and 8; bivariate plot, figure 4). It is considered in chapter 6.

e) observed patterns

The correlations of the within-division variability measures with other variables in the analysis revealed some fairly strong areal relationships. Table 4 shows these correlations for the two cities, for both ALP and participation variability, for the whole, the inner, and the outer city areas (the dichotomy is based upon city centrality, see chapter 5). The sociological factors and the regional contagion variable are explained in chapters 5 and 6 respectively.

Melbourne

	CV	nC	%ALP	%P	I$^{\delta}$nC	Con	SO$	CC	LCS
i)	Inner								
	ALP	.793	-.594	-.005	-.820	-.039	.559	.307	.450
	P	-.019	.586	-.067	.456	.486	-.395	.023	-.560
ii)	Outer								
	ALP	.554	-.557	-.279	-.248	-.218	.610	.097	-.315
	P	.187	-.345	.084	-.217	-.414	.354	-.223	-.353
iii)	Whole								
	ALP	.526	-.415	-.281	-.151	-.049	.554	.302	-.120
	P	.088	.201	-.394	.271	.058	-.016	.346	-.208

Sydney

i)	Inner							
	ALP	.755	-.796	-.218	-.439	-.560	-.841	-.148	.085
	P	.623	-.357	-.737	.257	-.271	-.404	-.679	.145
ii)	Outer								
	ALP	.498	-.735	-.197	-.437	-.335	-.469	.417	.765
	P	-.274	.063	-.414	.595	.634	-.743	-.194	-.371
iii)	Whole								
	ALP	.594	-.703	-.213	-.317	-.507	-.756	-.201	-.118
	P	.295	-.120	-.460	.446	-.293	-.117	-.578	-.103

INDEX:

CV = coefficient of variation type (ALP, Participation)
nC = number of candidates ($\log_{10}$)
%P = percentage participation
I$^{\delta}$nC = Informal vote with nC variance removed
Con = regional contagion (see chapter 6)
SO$ = socio-economic status (three factor solution)
CC = city centrality (" " ")
LCS = life cycle stage (" " ")

Table 4. Within-division variabilities for inner, outer, and whole city areas, correlated with other variables.

i) ALP variability

The only relationships which are similar for both cities and for both inner and outer city regions are that:

(a) within division variability increases as socio-economic status increases and as %ALP decreases,

(b) the number of candidates increases as variability increases.

There is a relationship between variability and regional contagion in Sydney but not in Melbourne, and there is a relationship between low informal vote and high variability which is weak and for all three regions for Sydney, but only strong in the inner city for Melbourne. The correlations with 'city centrality' and life cycle stage are quite variable within and between cities and do not seem to have a systematic pattern.

ii) Participation variability

On the whole the relationships with the participation variability are weaker and more mixed. Non-participation increases as variability increases in Sydney but not in Melbourne, and the informal vote generally increases as variability increases, but the relationship is weak and variable. The remaining correlations are somewhat mixed in pattern and are less easy to compare and interpret.

f) political variables check

There is a possibility that the correlation between the %ALP vote and the number of candidates could be partly due to some systematic regional within-unit ALP variability, and so the ALP variability measure was partialled from the correlation. In Melbourne the correlation changed from -.004 to .281, but in Sydney it changed from -.522 to -.184, implying that variability explains the correlation. As there are moderate correlations between the number of candidates and variability in both cities, there is probably a sociological reason for candidates being attracted to regions of variability. There is the relationship with high socio-economic status which was noted for candidates in Sydney previously (section 3c this chapter), and there is

probably the element of electoral uncertainty which attracts them.

The reduction of the correlation in Sydney is therefore probably due to social reasons rather than to measurement error.

A check was made on each electoral division which showed some 'isolate' status either in the regional grouping methods or in bivariate plots, and none of these were divisions with high internal variance. Consequently it was decided that within-division variability did not seriously confound the results of these methods - as far as could be determined with the measure used.

In summary, the measure of within-division variability is crude and somewhat unreliable, but the broad regional patterns displayed warrant further investigation. The measure has both methodological and sociological significance, though little theory about either exists to help in explanation. The measure is used in later chapters.

8. Action taken

Both %ALP and percentage participation figures are used unchanged, apart from a log transform of the latter. The variance of the number of candidates was subtracted from the percentage informal vote and the informal vote residual used in subsequent analysis.

Frequency polygons and maps of these three dependent variables are given in figures 7 - 10.

CHAPTER V

THE DATA MUNCHERS: ORDINATION AND CLASSIFICATION

Factor analysis is a form of ordination, and is used here to reduce a large number of variables to a few basic factors. These factors and the voting variables are then classified, regionally, in further analyses. The philosophy of data munching is followed by details of the factor analyses and the regional classification methods.

1. Philosophy of ordering

Given a data matrix, then ordering methods are used to search for some form of pattern (structure, order) in the matrix. The methods used in this thesis are of the similarity-grouping type and are dependent in their mechanics ultimately upon the purpose of the research. The purpose affects the choice of data and methods, and therefore results.

The basic hypothesis is that some form of systematic structuring exists in the data. There is no analysis of predetermined order, though the matrix may be selected upon preconceived notions, but there is an attempt to derive an objective ordering according to explicit criteria.

If a form of structure is derived, then the significance of this structure cannot be tested using the data from which it was derived; any chance variation will be maximised in deriving the structure (Williams and Dale, 1965). New data is therefore required to test the significance of the structure, and this condition usually forms the basis for a hypothesis that the obtained groupings will discriminate an external variable, i.e.that the new variable is of similar structure to those in the derived classes (Macnaughton-Smith, 1965).

Thinking about the weighting of variables is unavoidable also, for the most basic form of weighting is in the selection of the individuals and attributes (variables) to be ordered (the output is dependent upon the input).

Apart from this, one must decide if each cell of the data matrix is to be treated equally. The Adansonian principle that 'every character is of equal weight' is itself a form of weighting. It is analogous to the Laplacian principle of assigning equal probabilities to events when information to the contrary is lacking. Nevertheless most ordering methods use this assumption, and it has been used in this thesis because there is little reason for an alternative assumption (Harvey 1969).

The forms in which 'weighting' occur are numerous and include the use of constants, repetition of individuals or attributes, and the existence of logical (or nuisance) correlations amongst attributes which consequently weight some common factor. Unstandardised variables are 'weighted' by the absolute distances between values, whilst standardised variables are 'weighted' by their profiles. This is a 'size versus shape' weighting, and choice must be made accordingly.

For this study the variable profiles are compared (correlation analysis does this) and so all variables are standardised before analysis. As the voting variables are being compared to factor scores which are given in an already standard form, then in order to maintain comparability, and to be consistent with the profile-comparison of correlation, all variables are standardised before classifying regionally.

Most methods weight the variables by the very nature of their method. For example, the location of a centroid in a centroid fusion of two groups may be based upon either the equalisation of or upon the relative sizes of the two groups. If the latter, then the variables associated with the larger group will be weighted more (Johnston, 1970; Spence and Taylor, 1970). Group or factor equalisation has been used as a general principle throughout the study.

The structure of groups or factors is dependent upon the sample (individuals, attributes, time period, etc.), and therefore upon definitions, type or size, numbers, purpose etc. Any generalisation must be made with these in mind.

2. Factor analysis

Factor analysis groups variables into syndromes rather than into discrete categories, and consequently each variable has a correlation (or 'loading') upon each factor (syndrome), and each areal unit will also have a score for each factor. The continuity between units or variables is more easily represented by ordination, in contrast to the categories of, say regional grouping.

a) Outline

The purpose in using factor analysis here is to reduce a matrix of 17 variables to a few 'underlying' factors, and to get scores for these factors to use for further analysis. Having obtained the factor scores, they can then be used just like any other variable in correlation and grouping etc.

There are a great many variations coming under the generic heading of 'factor analysis', but these provide a flexibility which can either be incorporated into or can be used selectively for many research designs. Given a 'galaxy' of variables, then the first decision is whether to place orthogonal or oblique axes through the galaxy. Orthogonal ones were chosen here for two reasons. The first reason is that much of the existing social area analysis uses orthogonal factors, and so comparability is easier, and the second reason is that orthogonality gives factors with zero correlation between them, and this makes subsequent analysis easier.

A second decision is in whether to use rotated or unrotated factors. The unrotated factors successively define the most general patterns of relationships in the data, whereas the rotated factors define distinct clusters of relationships (Rummel, 1967); an unrotated axis could be placed between clusters. As clustering is required, then the rotated factors are used for this study (using the Varimax method with unities in the diagonal). Varimax factor scores were obtained precisely: a program for this is given in Veldman (1967).

A third decision is in the number of factors to extract, and there are two criteria to be considered: the statistical base and usefulness. Inferential statistics cannot logically be used in this study, and so, descriptively, any number of factors can be extracted and used. Nevertheless the effect of spatial dependency is still unknown and so guidelines using statistical inference are used as extra criteria for extraction. Nunnally (1967, p.357) gives a rule of thumb method for estimating the importance of error variance, and the extraction of three factors (the maximum number used in this thesis) falls within his range of estimated safety.

Apart from an outer limit, determined statistically if the data form a sample, there is no 'correct' number of factors to extract, only factors more or less appropriate to the purpose of the study. The usefulness of the later factors extracted is assessed by the researcher using his own knowledge and theory. Janson (1969) also suggests that with rotated factors the changing composition of the factors as more are extracted should be of interest. A previous study (Herbert, G, 1969) showed that for Sydney the difference between the three and the four factor solutions was that the third factor splits into two subfactors (for the four factor solution) which were shown to be practically the opposite poles of the one factor when plotted and mapped. The first two factors remained virtually unchanged whether three or four factors were extracted however. Thus whilst the third factor was quite different to the first two, there was no practical reason to go beyond three factors. The findings of this pilot study were assumed to apply to this thesis, as the data were quite similar, and so only the two and the three factor solutions are used in analysis.

Whether or not to use factors from the two factor or from the three factor solution will depend upon what dependent variable is to be analysed, and upon the research design in relation to the mathematical or social properties of the factors. For instance the factors from a two factor solution may be very similar for two cities, but those from a three factor solution might differ a lot; between-city comparability would then require the use of the two factor

solution. The number of factors can also be varied systematically to find which is most appropriate: interpretation then considers the variable composition and geographical distribution of that particular factor (or combination of factors).

A fourth decision is whether to use an 'R' analysis, in which columns are factored, or a 'Q' analysis in which rows are factored. Obviously this depends upon whether one wants factors of variables or of areal units. In this thesis both are considered and referred to; the 'R' analysis is, however, the one of main concern.

Having made these decisions and extracted the limit of three factors, then they were found to be quite similar to factors extracted both overseas and in Australia (Janson 1969, Jones 1968). Because of the macro-scale of analysis and the basic approach of searching for relationships, then minor variations in the composition of these factors, which are comparatively invariant over a wide range of economically developed cities, is of little importance.

b) Variables selection and transformation

The 17 variables selected for factor analysis were based upon previous social area analyses, the availability of census data, and a preliminary pilot study (Herbert,G, 1969). They are given in detail in appendix A. The relative numbers of variables associated with each factor is less important for the structure of rotated factors than for unrotated factors, and is generally unimportant (within the limit of extracting the desired type of factors) for this study as all derived factors are treated equally in correlation and grouping.

All skewed univariate frequency distributions were log transformed to approximate normality in order to maximise the possibility of bivariate normality. The bivariate normality gives linear relationships and a higher r coefficient in the initial inter-correlation matrix, and this makes possible firstly more significant factors and secondly factors which are themselves multinormal, linearly related, and independent (Janson 1969). For example if

many curvilinear relationships are factored, then the factors themselves will be curvilinear in structure (with orthogonal axes superimposed), and the distribution of factor scores is likely to be skewed (Janson, 1969; Noy-Meir, 1970; Swan, 1970). However there is one drawback in transforming to normality and this is that the distribution profile is altered when profile-shape comparison is the method of grouping (both in the factor analysis and in the regional grouping). This choice between profile authenticity and a more malleable methodology should be made with a full knowledge of the strengths of each. The overriding reason for normality is that it gives linear regression relationships and so allows an accurate interpretation of simple, partial, and multiple correlation, and of rotated factors. However in the transformation some information is lost - the skew - and this may be of great sociological significance. In the city the skew is most likely to be located in two geographical areas - the periphery and the centre. The large peripheral units are inadequate for the measurement of certain indices (e.g. population density) and there the skew is sometimes measurement error; obviously there is little objection to transforming this out. The inner city however contains mostly valid skew values, e.g. extreme ratios for unemployment, and in transforming these out this 'size' element is either muted or lost. Janson (1969) found that a 'size' factor was the only difference in one study between using transformed and untransformed variables in factor analysis.

There are further complications when comparing cities, for the profiles for the same variable can differ between cities, and, whether one transforms all to normality or leaves them as found, there will be some difficulty in interpreting the comparison of factors because of the differences of the variable profiles. All skews were normalised (approximately) for the main study, and the transforms used are listed in table 5. Appendix B gives the tables of intercorrelations for the two cities.

Var.No.	Melbourne	Sydney
1.	-	Log 10
2.	Log 10	-
3.	-	-
4.	-	-
5.	Log 10	-
6.	Antilog e	-
7.	Log 10	Log 10
8.	-	Antilog e
9.	-	-
10.	Log 10	Log e
11.	Log e	Log e
12.	-	Log 10
13.	Log 10	-
14.	Log 10	-
15.	-	-
16.	Log 10	-
17.	-	-

Table 5. Variables transforms used

In order to investigate the effects of transforming, comparisons were obtained between factors derived from transformed and factors from untransformed variables, for the same city. Between-city comparisons were also made using factors from both transformed and untransformed variables. To do this separate factor analyses were run using a set of untransformed variables and a set of transformed variables. The factors were then compared using program RELATE (Veldman 1967) which gives a matrix of cosines between factor vectors (i.e. correlations between factors) and a list of correlations between individual variables (i.e. cosines between variables vectors when the factors have been maximally alligned). For the same city the factors derived from the transformed and untransformed variables can be compared either by correlating their factor scores or by using program RELATE. However, factors derived from the same variables can be compared between cities only by using program RELATE. As a matter of convenience all comparisons were made by using RELATE.

		Untrans. SO$	Untrans. LCS
Trans.	SO$	.9978	.0658
	LCS	-.0658	.9978

Table 6a. Sydney: two factors

		Untransformed SO$	Untransformed LCS	Untransformed CC
Trans.	SO$	.9989	-.0131	.0435
	LCS	.0171	.9951	-.0964
	CC	.0420	-.0970	-.9945

Table 6b. Sydney: three factors

		Untrans. LCS	Untrans. SO$
Trans.	LCS	.9999	.0143
	SO$	-.0143	.9999

Table 6c. Melbourne: two factors

		Untransformed CC	Untransformed SO$	Untransformed LCS
Trans.	CC	.9997	.0121	.0207
	SO$	-.0122	.9999	.0026
	LCS	-.0207	-.0029	.9998

Table 6d. Melbourne: three factors

INDEX : SO$ = Socio-economic status
LCS = Life-cycle stage
CC = City centrality

Tables 6 a-d. Correlations between factors based upon transformed and untransformed variables.

The results of the comparison of using either transformed or untransformed variables within both cities are given in tables 6 and 7. Tables 6 (a-d) show that, for whether the variables are transformed or untransformed, there is practically no difference between the factors, for both the two and three factor solutions and for both cities. Table 7 similarly shows practically no change in the importance of individual variables. In Sydney 'population density' changed most, but the correlation is still very high for both two and three factor solutions. In Melbourne 'education' changed most for the two factor, and 'youth' changed most for the three factor solution, but again the correlations are very high. These correlations are not invalid artifacts of method; some error for a variable was inadvertently made during data coding for the computer and the consequent r value given was quite low (it thus served as a diagnostic for the error).

Var.No.	Sydney		Melbourne	
	II	III	II	III
1.	.9917	.9698	.9999	.9998
2.	1.0000	.9972	1.0000	.9934
3.	1.0000	.9996	1.0000	.9998
4.	1.0000	1.0000	1.0000	1.0000
5.	.9999	.9947	.9983	.9956
6.	.9994	.9989	1.0000	.9998
7.	.9998	.9953	.9995	.9995
8.	.9997	.9992	1.0000	.9992
9.	1.0000	.9866	.9999	.9966
10.	.9995	.9987	.9987	.9969
11.	1.0000	.9998	.9980	.9983
12.	.9974	.9886	1.0000	.9999
13.	1.0000	.9914	.9999	.9951
14.	.9998	.9991	1.0000	.9999
15.	.9999	.9999	1.0000	.9997
16.	1.0000	.9978	.9999	.9997
17.	.9999	.9901	1.0000	.9982

Table 7. Correlations between transformed and untransformed variables, for the two and three factor solutions.

The inference to be taken from tables 6 and 7 is that transforming the original variables made very little difference upon the derived factors. One would therefore expect any inter-city differences to be primarily sociological rather than being a product of measurement variation.

c) Factor results

For the two factor solution the order of extraction was

Sydney: Socio-economic status, Life-cycle stage
Melbourne: Life-cycle stage, Socio-economic status.

For the three factor solution the order was

Sydney: Socio-economic status, Life-cycle stage, City centrality
Melbourne: City centrality, Socio-economic status, Life-cycle stage.

The factors from the two factor solution need little explanation; variables loading highly upon socio-economic status are occupation type, occupation status, education, rooms per house, etc., whilst those loading highly upon life-cycle stage are population density, youth, singularity, female employment, unemployment, etc. (see appendix D for the varimax loadings).

Life-cycle stage is a demographic dimension in which young families with many children and non-working wives are located towards the outskirts of cities, and single or aged people are located towards the inner city. A person is statistically more likely to be born in the outer suburbs (or inner if he is the first child, with the family moving out later), to move to the inner city when a young adult worker, and to move back to the outer suburbs with marriage and family. As the city is usually expanding, then by the time a couple reaches middle or old age their previously peripherally located home is now in the middle or inner suburbs. They may move to a retirement home in old age.

In both cities the third factor, city centrality, sociologically and geographically 'joins' the first two factors. Socio-economic status is a primarily sectorally oriented factor whilst life-cycle stage is primarily concentrically oriented (see figures 9 and 10). Located in the inner city, city centrality contributes to both factors in the two factor solution. However in Melbourne, city centrality became the first factor extracted in the three factor solution, displacing life-cycle stage in importance. The three factors in Melbourne appear to be much more mixed in comparison to Sydney, but this is investigated below.

City centrality is a mixture of variables such as unemployment, non-Australian born, persons per dwelling, house without a car, and sociologically is a composite of age, relative poverty, singularity, and a large itinerant population. Although the factor is called 'city centrality', there is a slight rise in its values in outer suburbs of low economic status. These suburbs usually contain housing commission ('council house') estates and so some of the social characteristics of the inner city could simply have been transported to these estates.

Appendices A to G give full details of the analyses for both cities. The frequency polygons for factor scores and the mapped patterns of the factor scores are given in figures 7 to 10.

As some of the factor score distributions are quite skewed it is apparent that multinormality of both variables and factors does not exist for the study, and that if truly linear relationships are required for analysis then bivariate plots will be required to assess the linearity.

The significance of some of the skews is as follows. In both cities life-cycle stage (two factor) is concentrically oriented, as are both its counterpart and city centrality from the three factor solution. It appears that the latter two factors are predominantly derived from life-cycle stage (two factor), but with the addition of some inner-city skew from socio-economic status (two factor),

SYDNEY: FREQUENCY POLYGONS

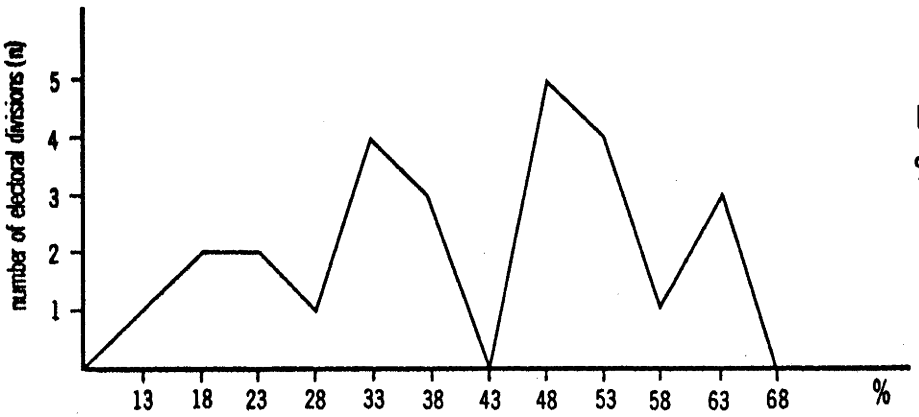

Fig. 7a.
% ALP vote

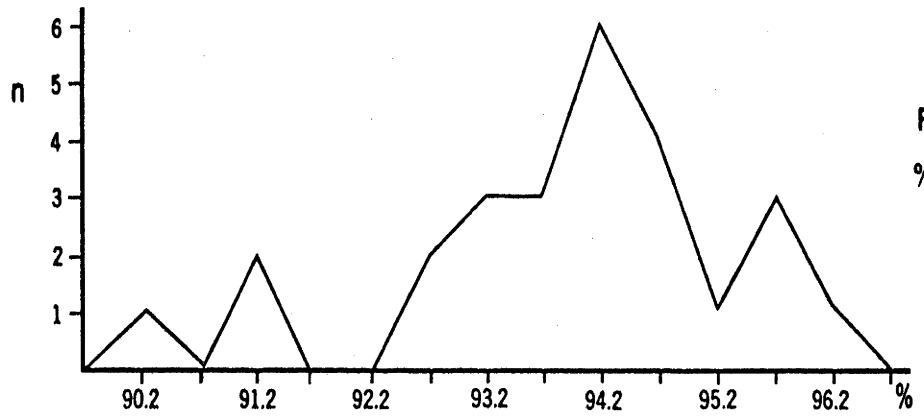

Fig. 7b.
% Participation

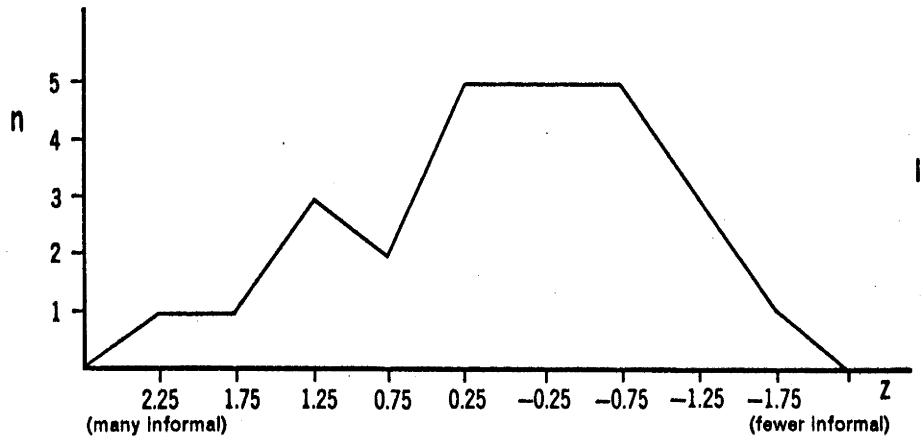

Fig. 7c.
Informal minus candidates

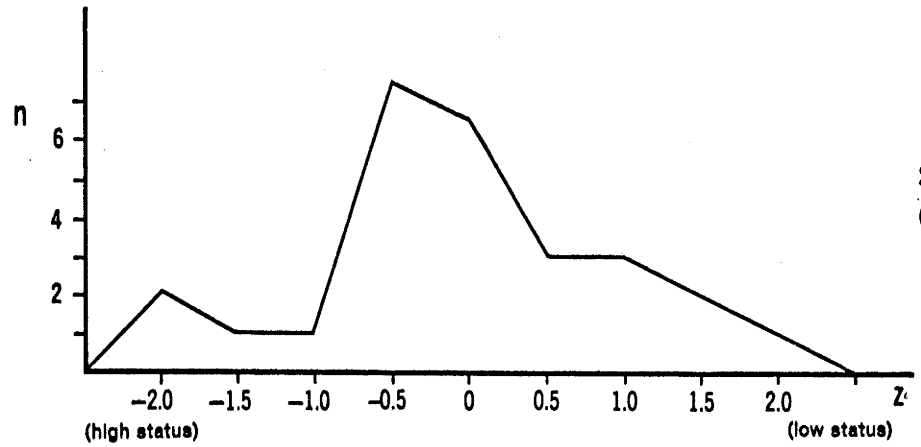

Fig. 7d.
Socio-economic status
(two factor)

SYDNEY: FREQUENCY POLYGONS

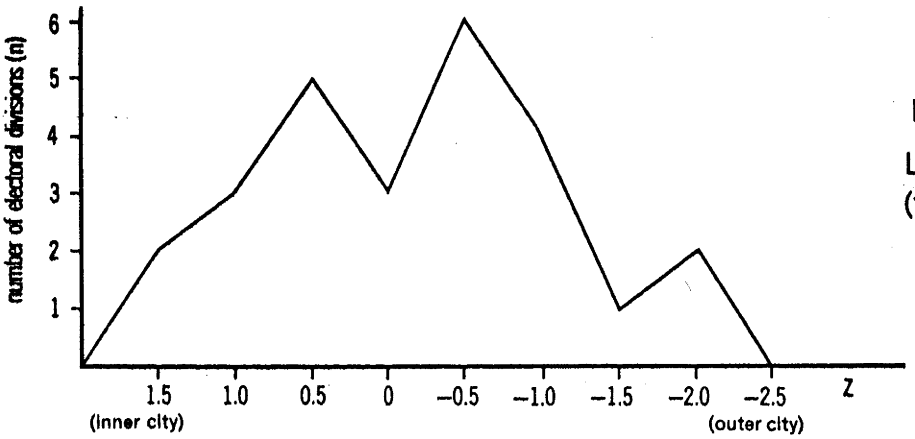

Fig. 7e.

Life-cycle stage
(two factor)

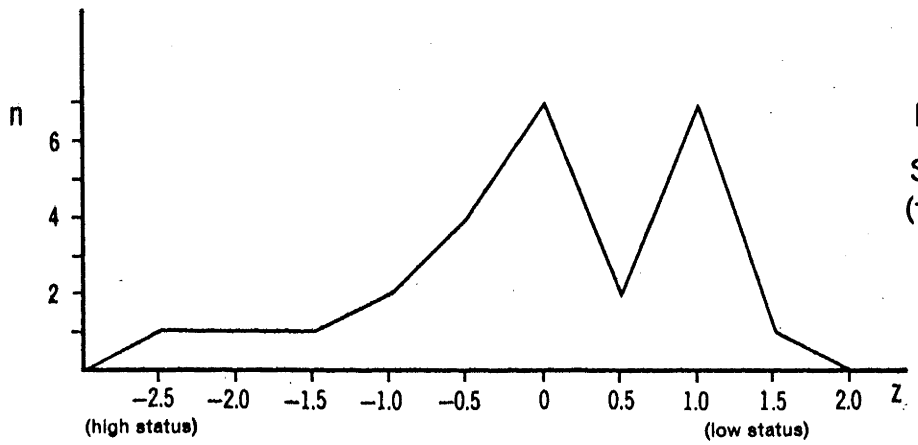

Fig. 7f.

Socio-economic status
(three factor)

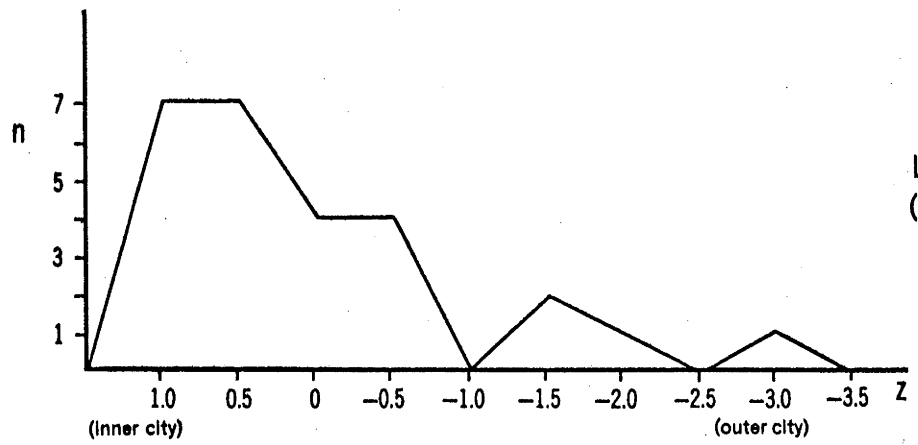

Fig. 7g.

Life-cycle stage
(three factor)

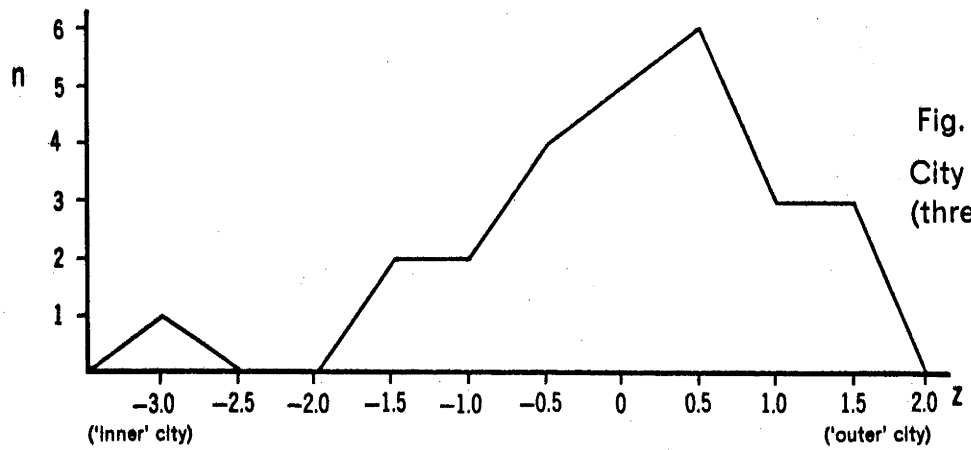

Fig. 7h.

City centrality
(three factor)

MELBOURNE: FREQUENCY POLYGONS

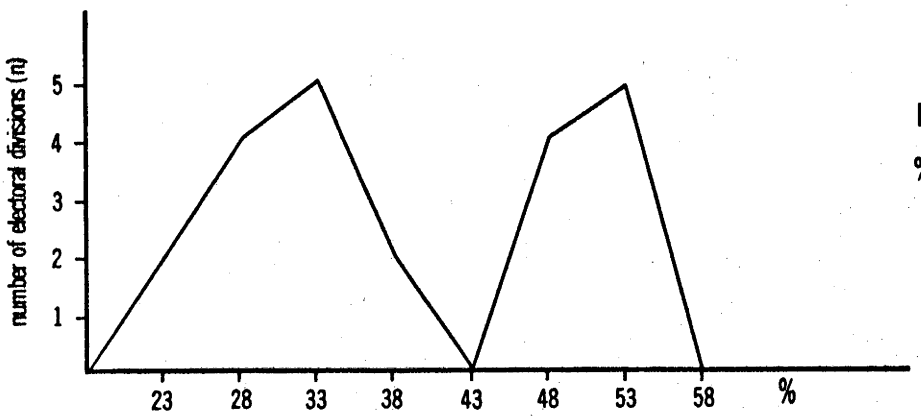

Fig. 8a.
% A L P vote

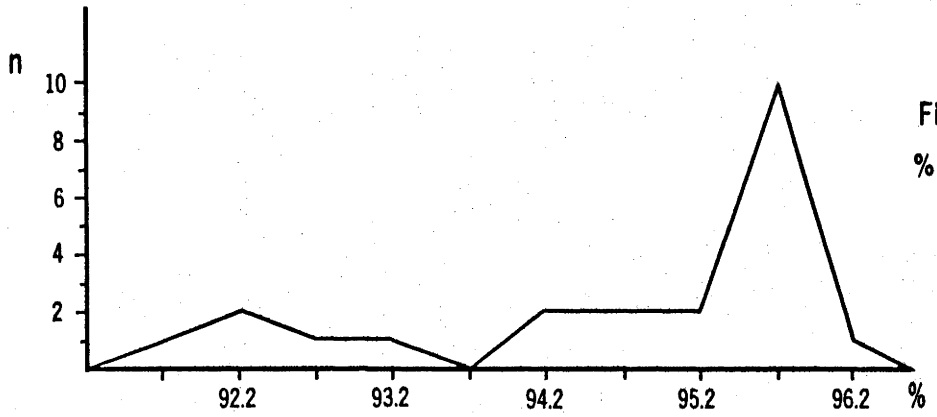

Fig. 8b.
% Participation

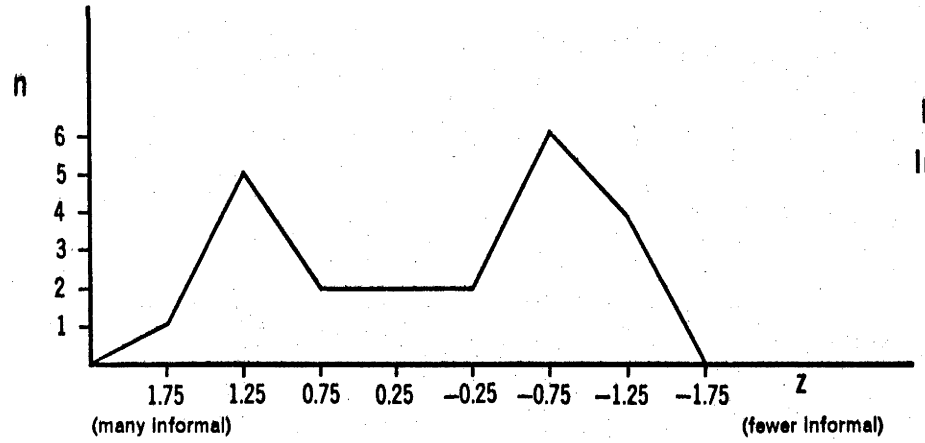

Fig. 8c.
Informal minus candidates

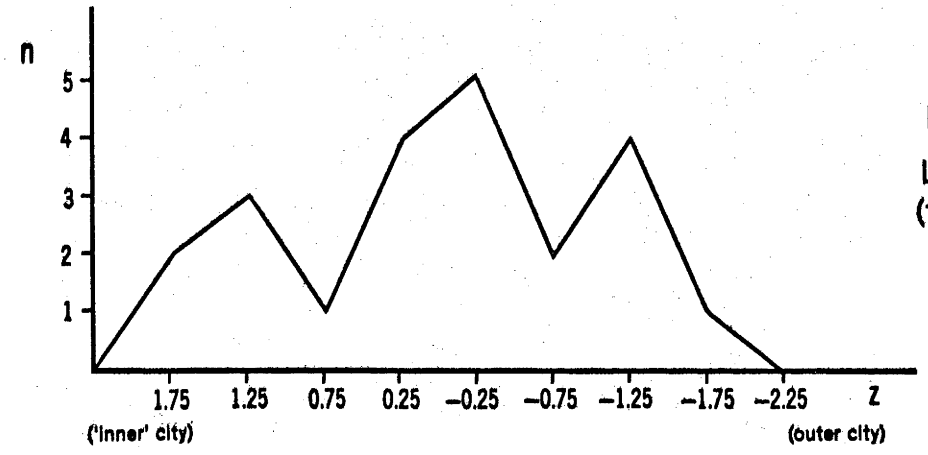

Fig. 8d.
Life-cycle stage
(two factor)

MELBOURNE: FREQUENCY POLYGONS

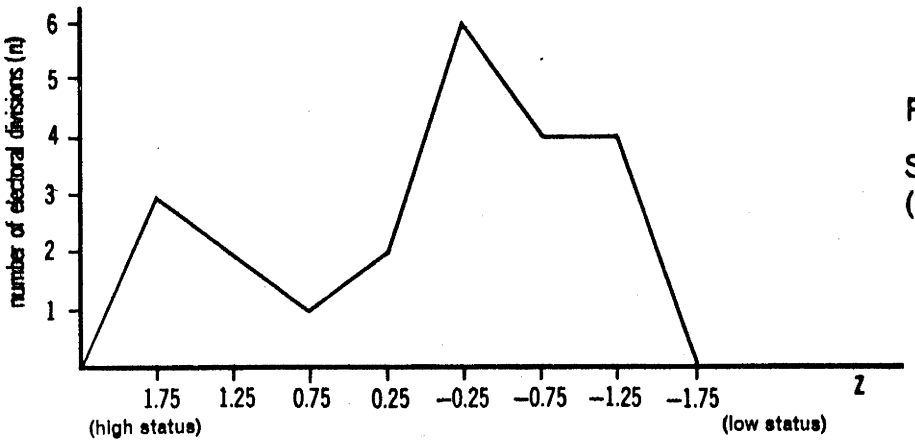

Fig. 8e.

Socio-economic status (two factor)

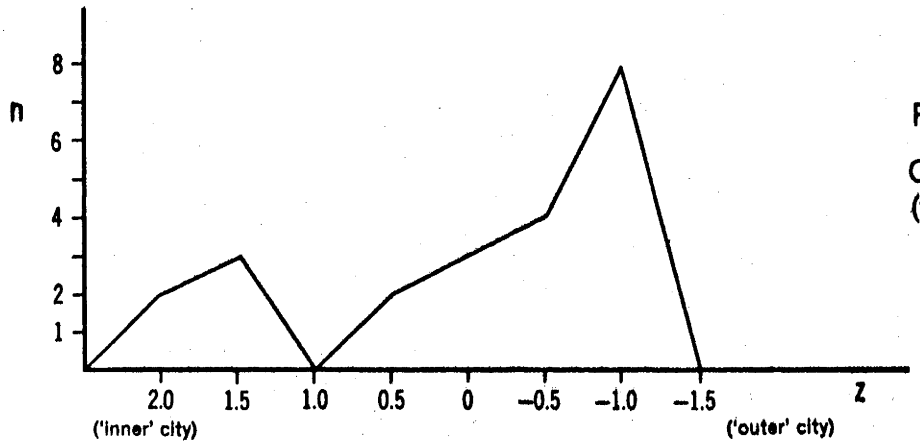

Fig. 8f.

City centrality (three factor)

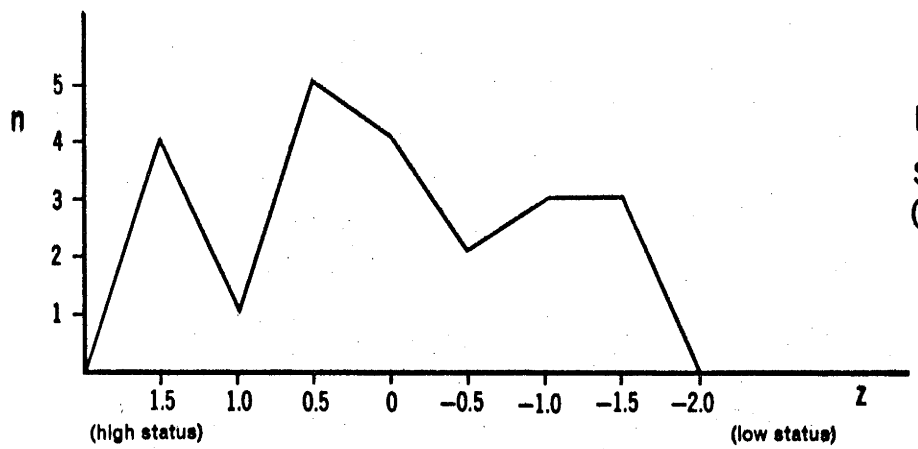

Fig. 8g.

Socio-economic status (three factor)

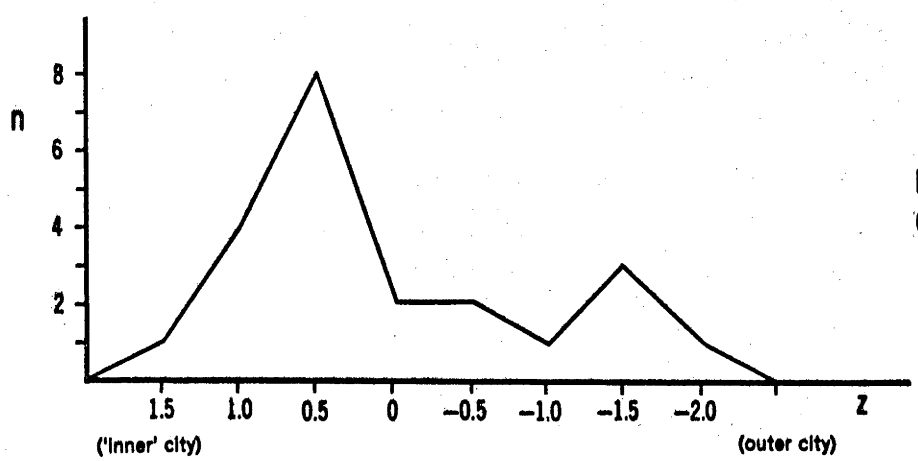

Fig. 8h.

Life-cycle stage (three factor)

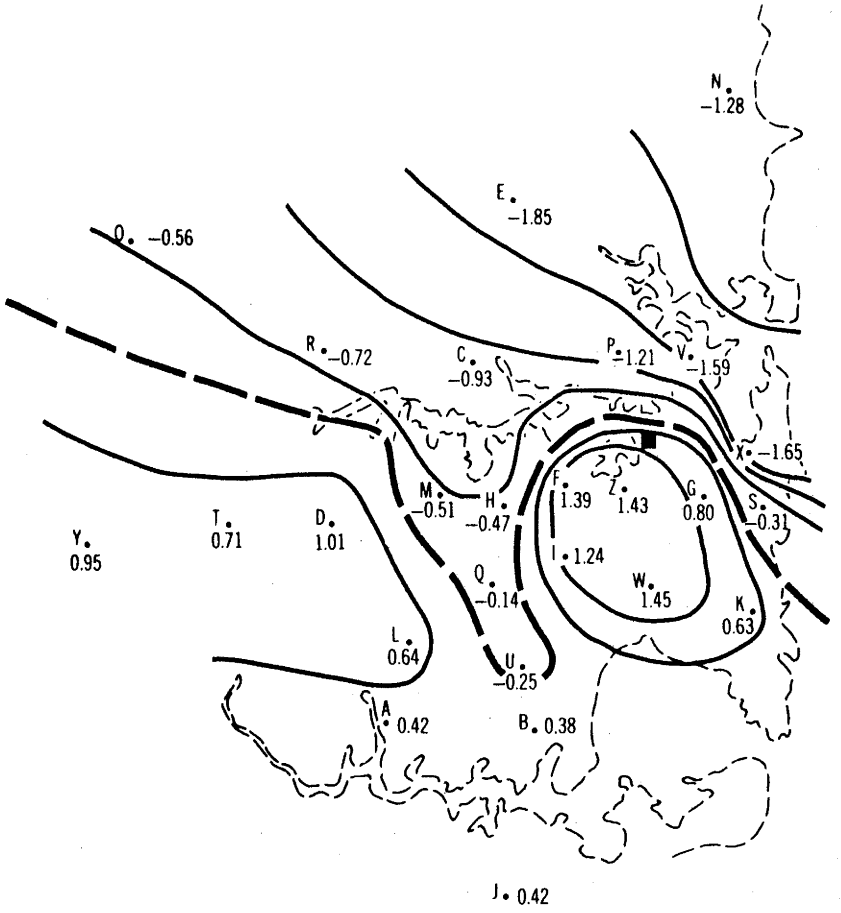

Fig. 9a % ALP vote

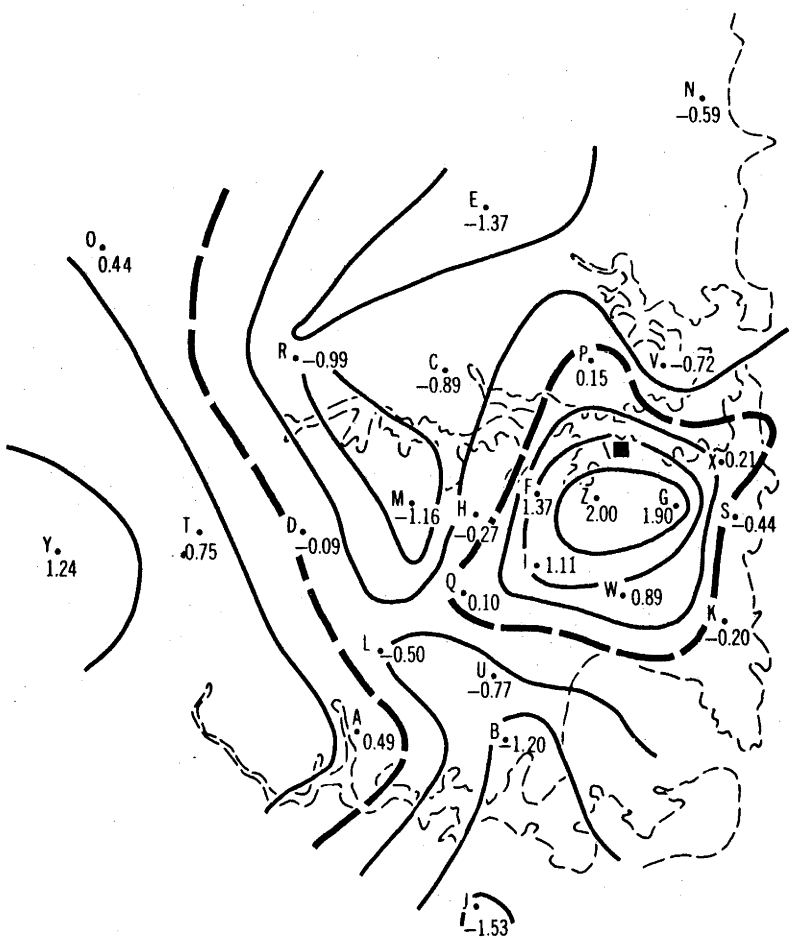

Fig. 9b Informal vote with candidates variance removed

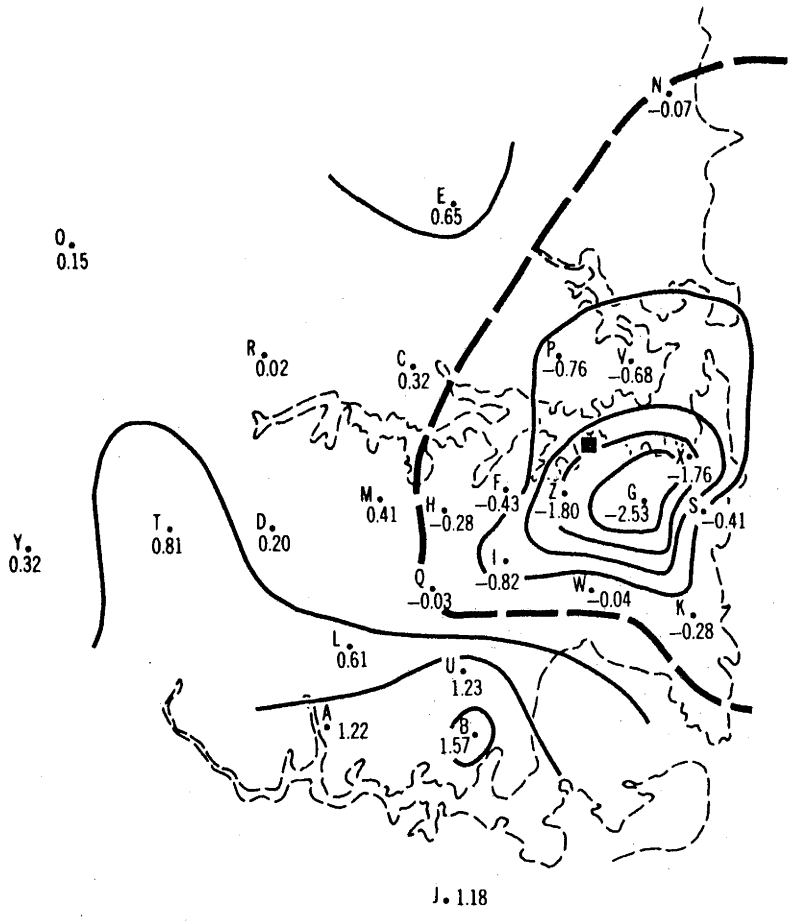

Fig. 9c Participation

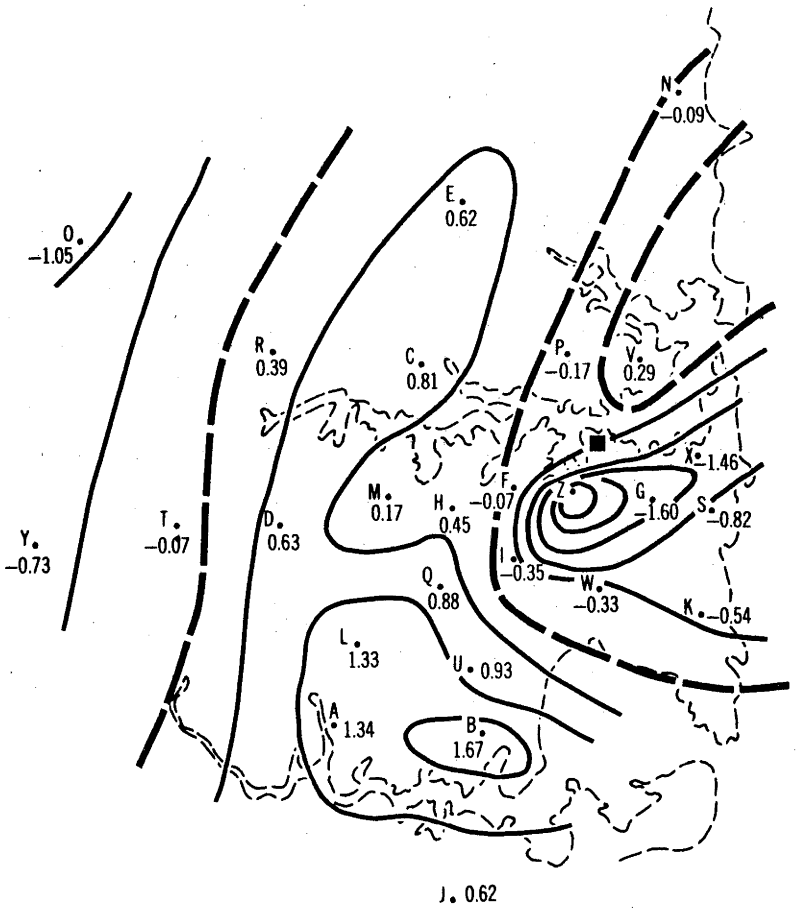

Fig. 9d City centrality (three factor)

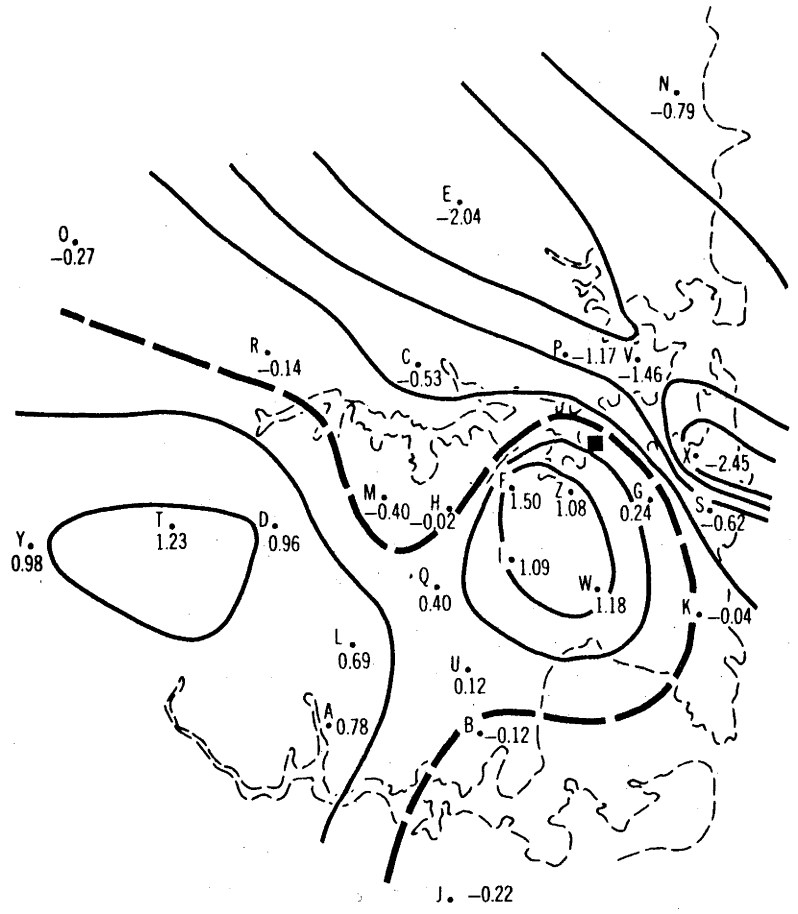

Fig. 9e Socio-economic status (three factor

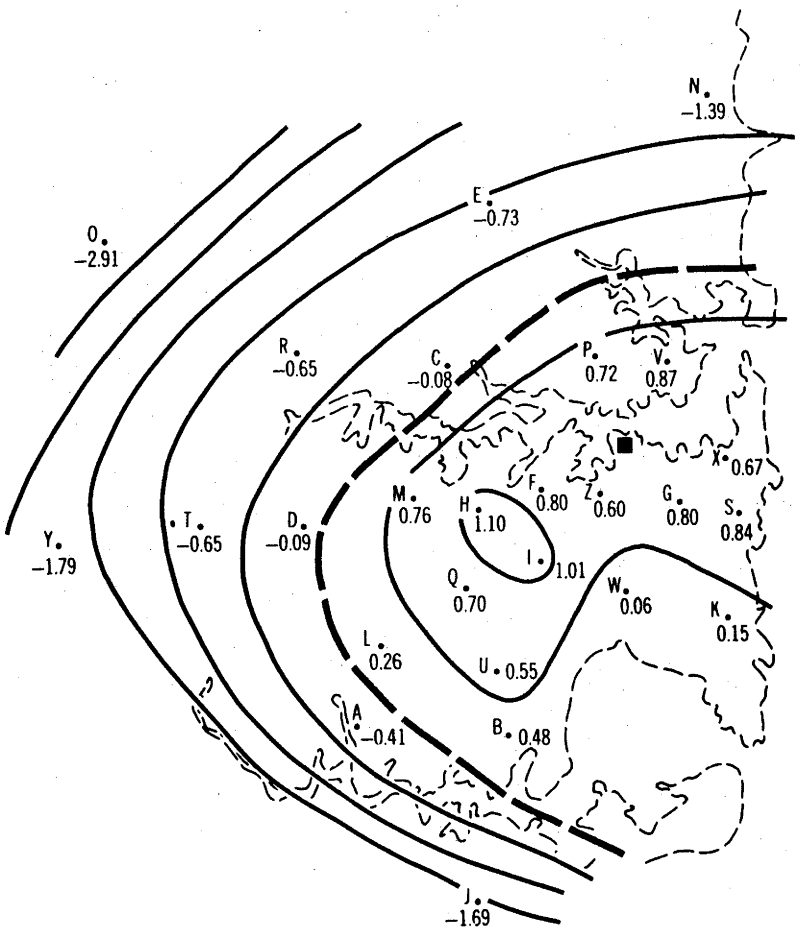

Fig. 9f Life-cycle stage (three factor)

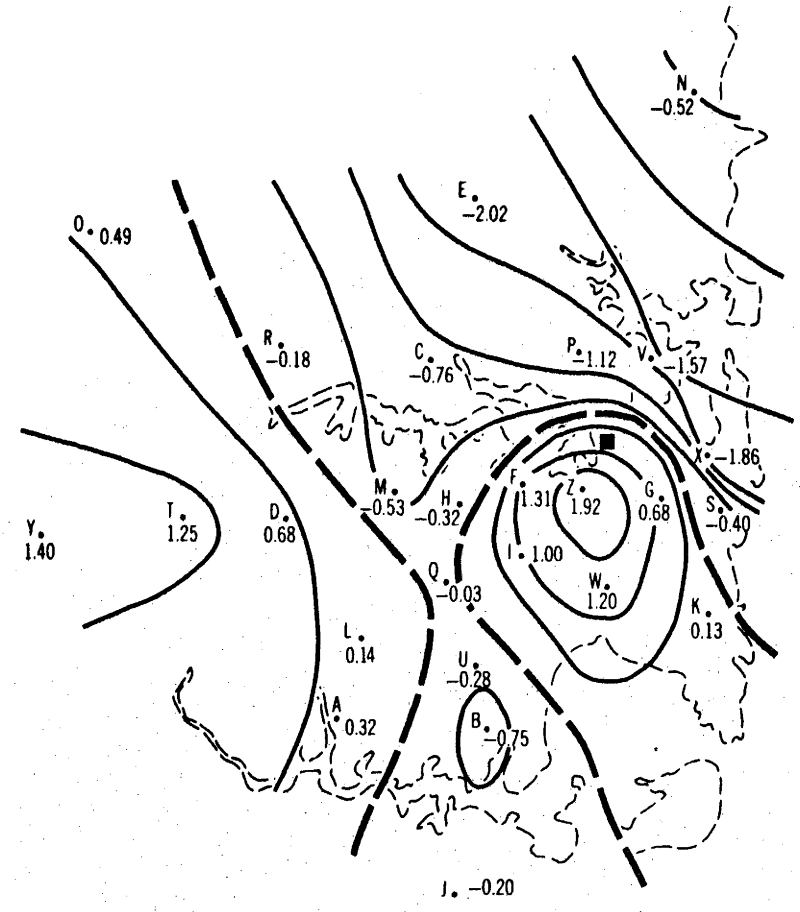

Fig. 9g Socio-economic status (two factor)

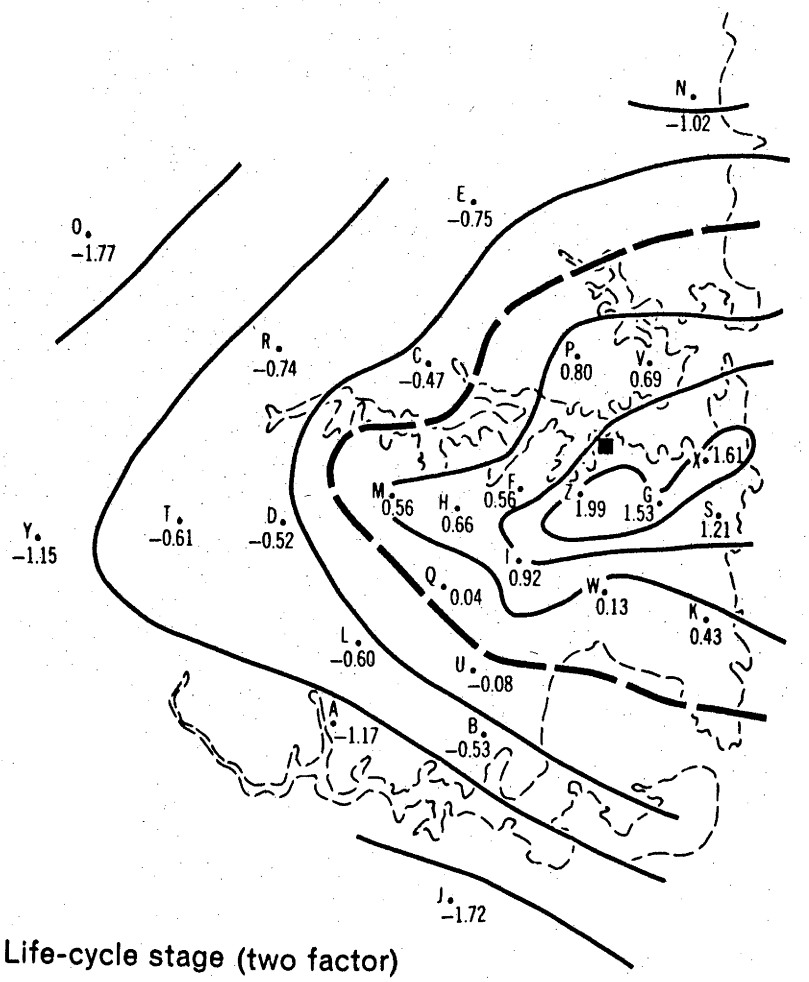

Fig. 9h Life-cycle stage (two factor)

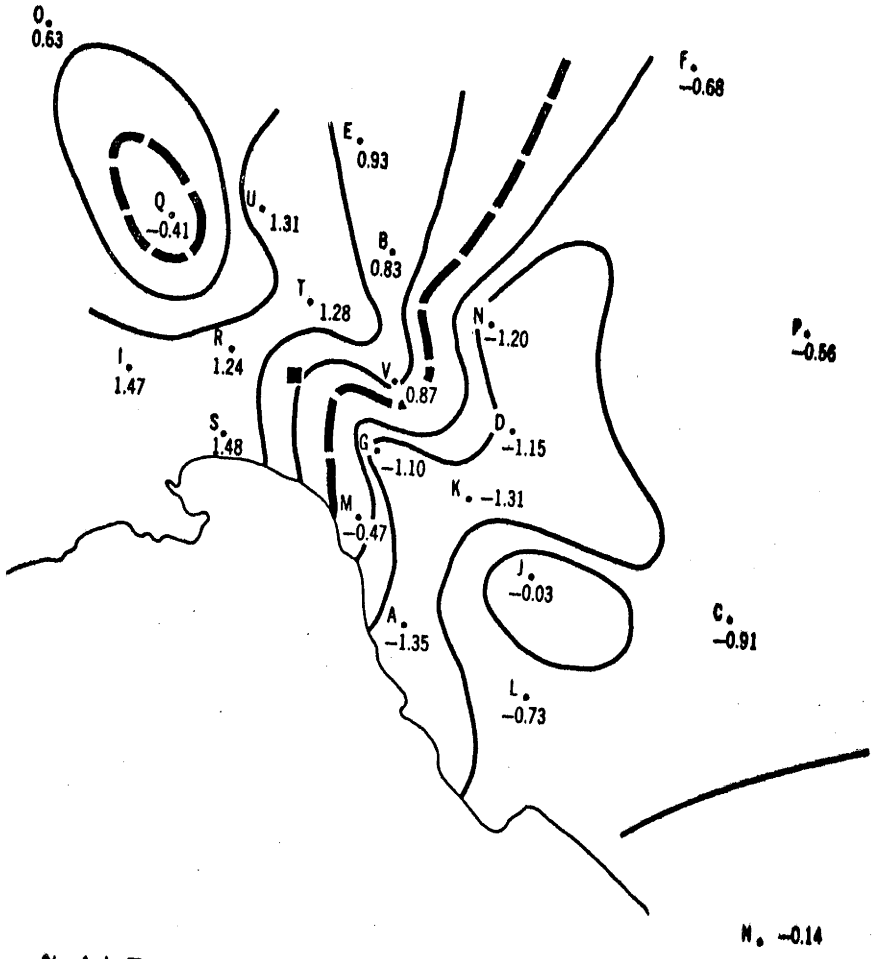

Fig. 10a % ALP vote

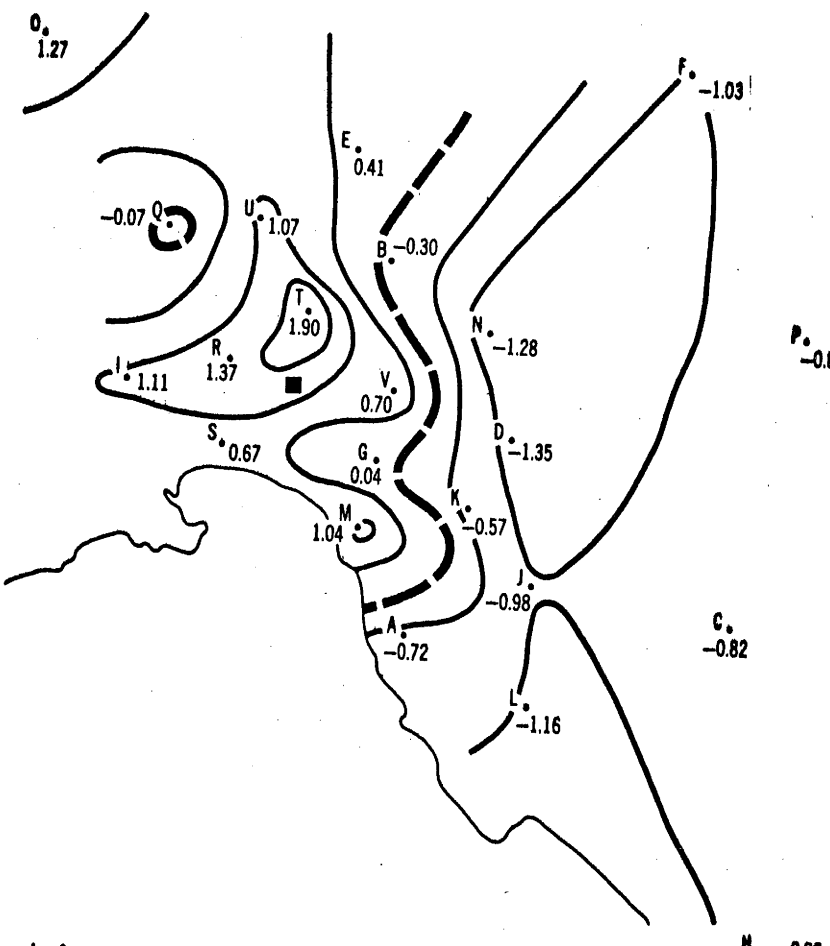

Fig. 10b Informal vote with candidates variance removed

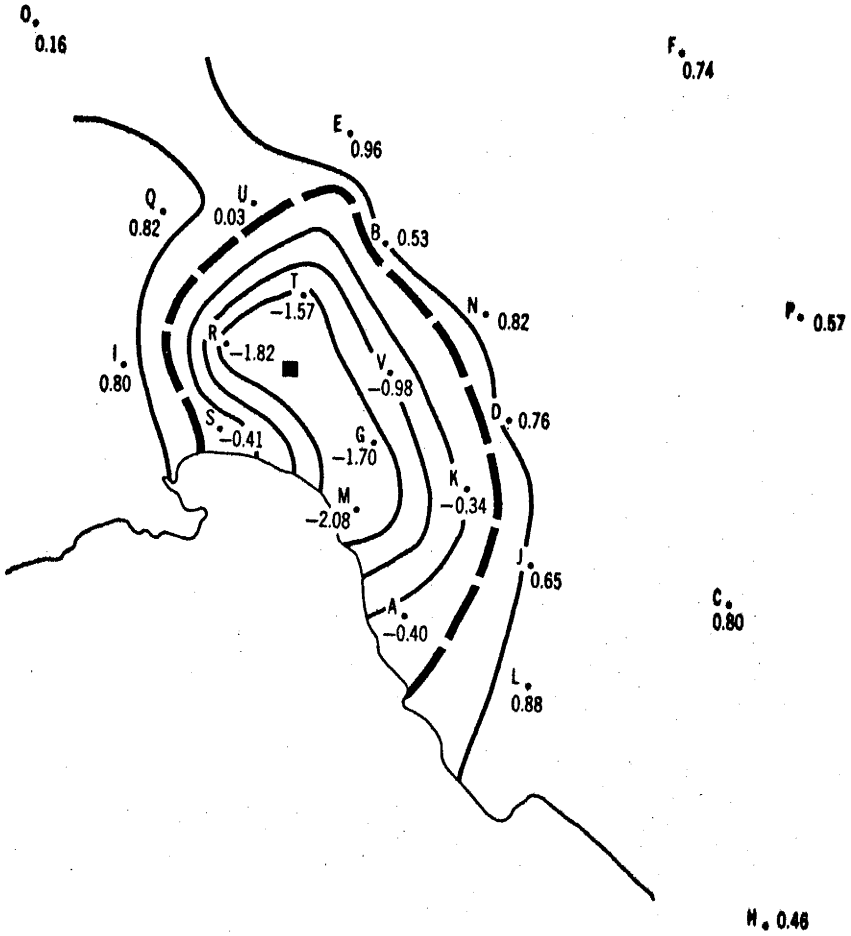

Fig. 10c Participation

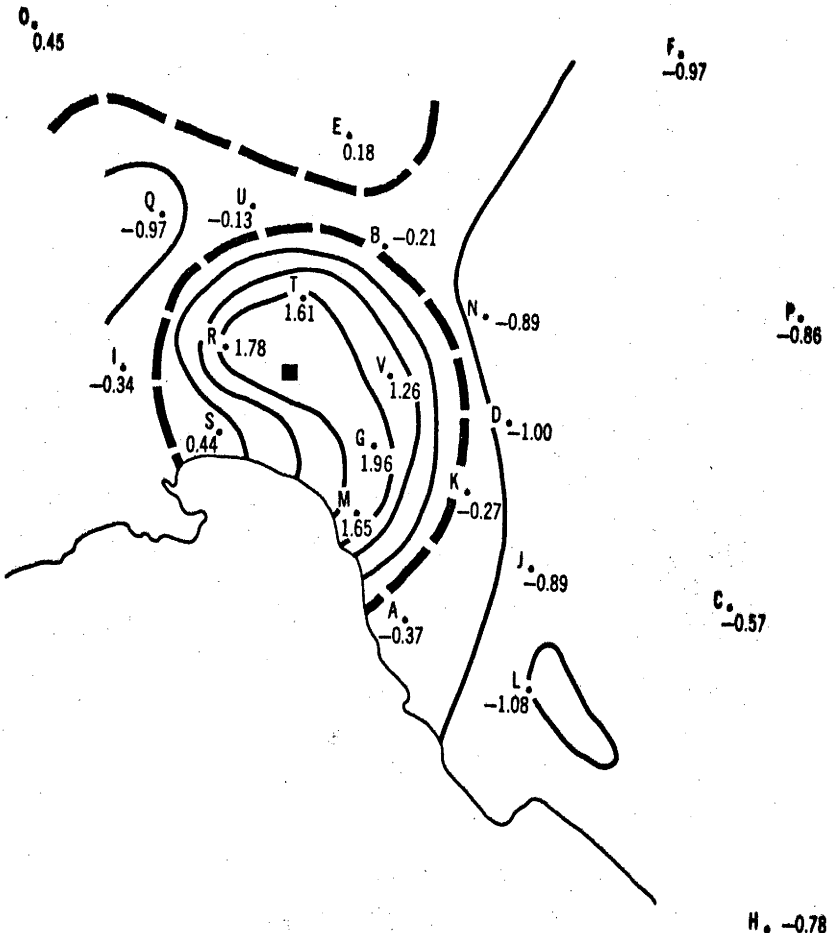

Fig.10d City centrality (three factor)

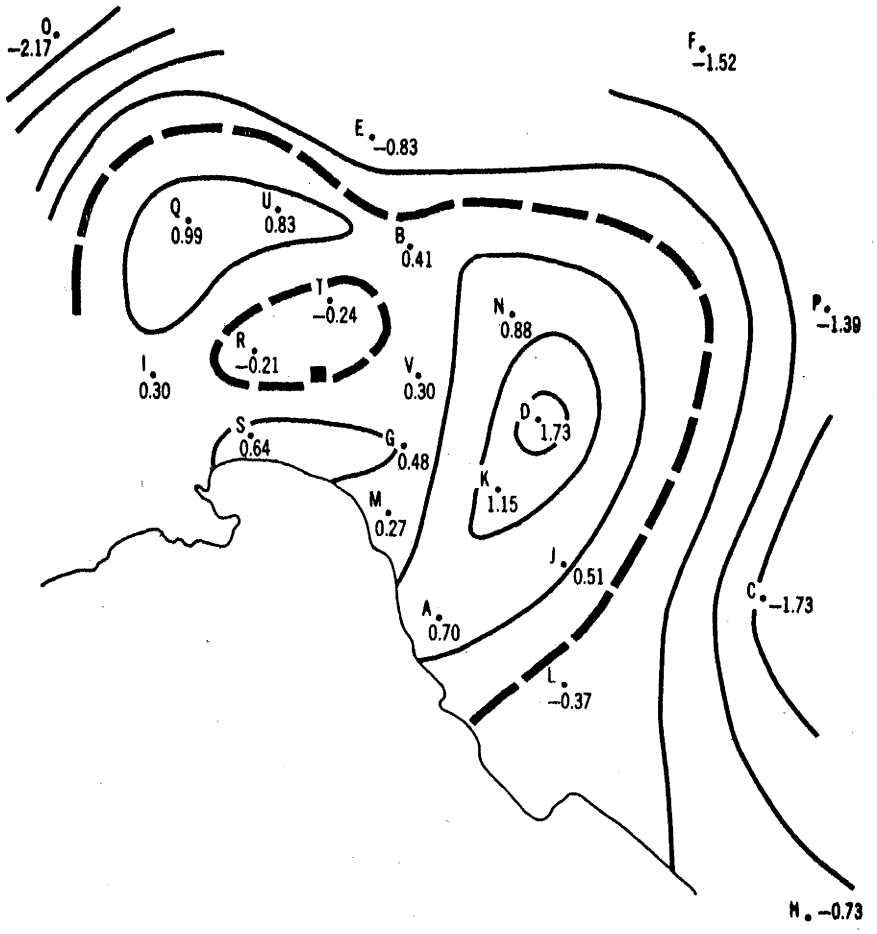

Fig.10e Life-cycle stage (three factor)

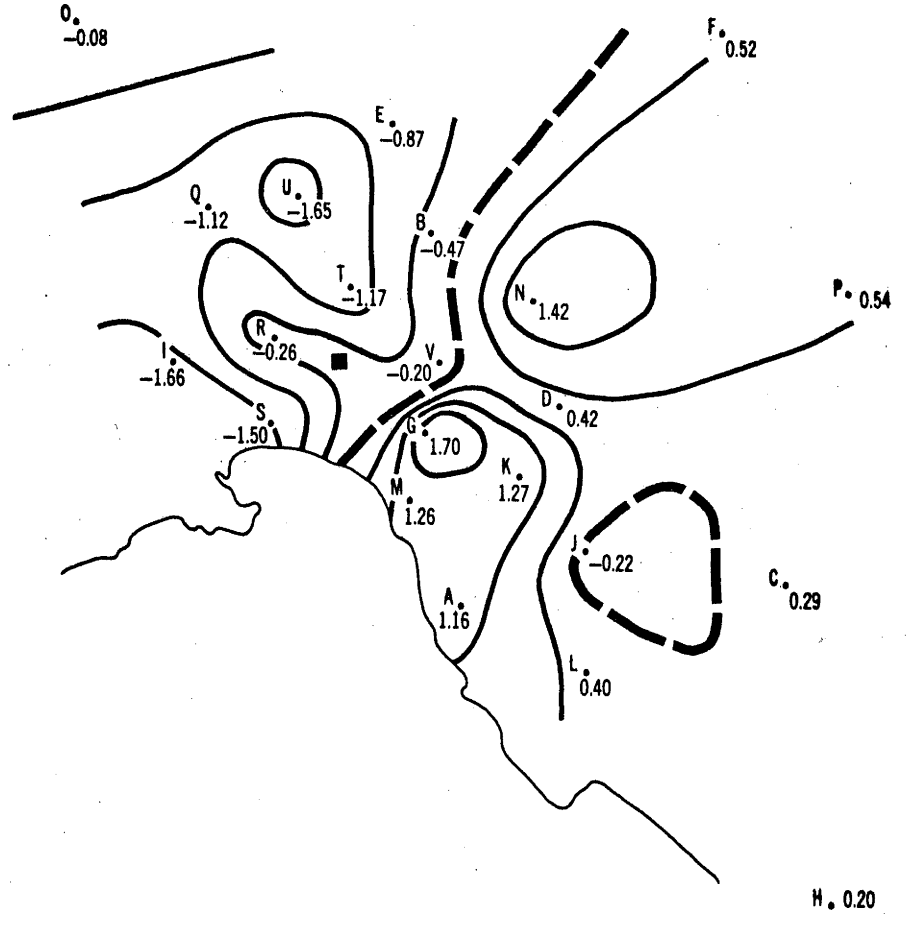

Fig. 10f Socio-economic status (three factor)

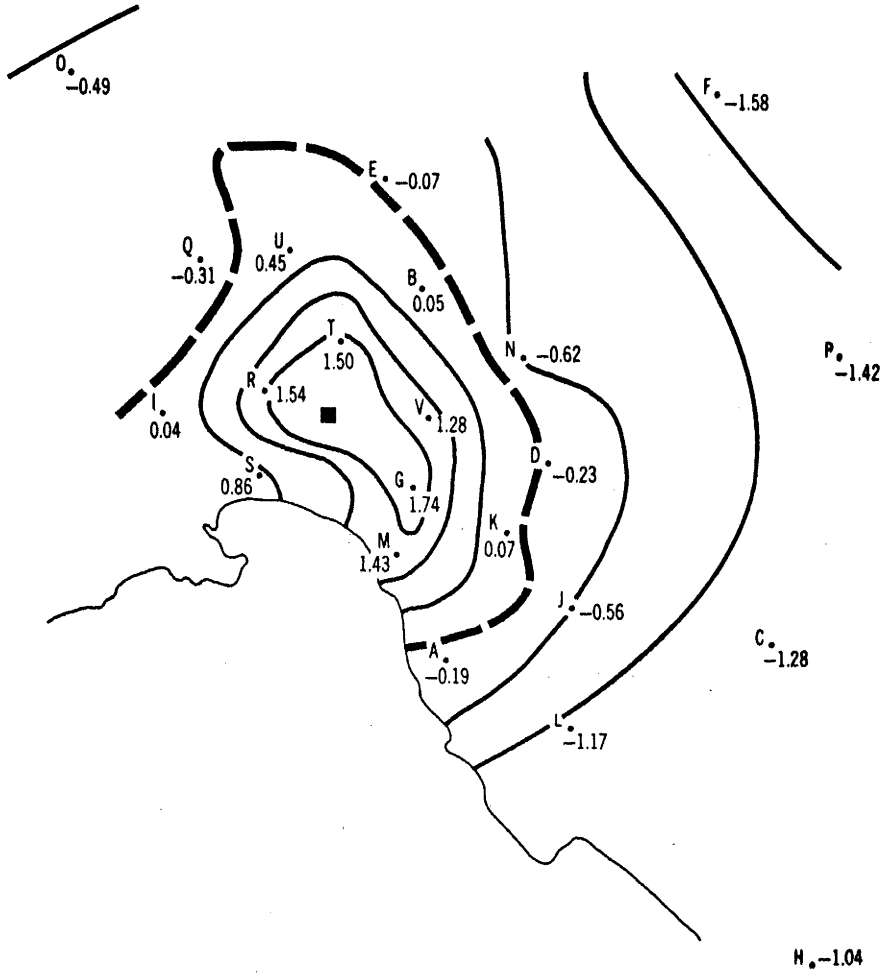

Fig.10g Life-cycle stage (two factor)

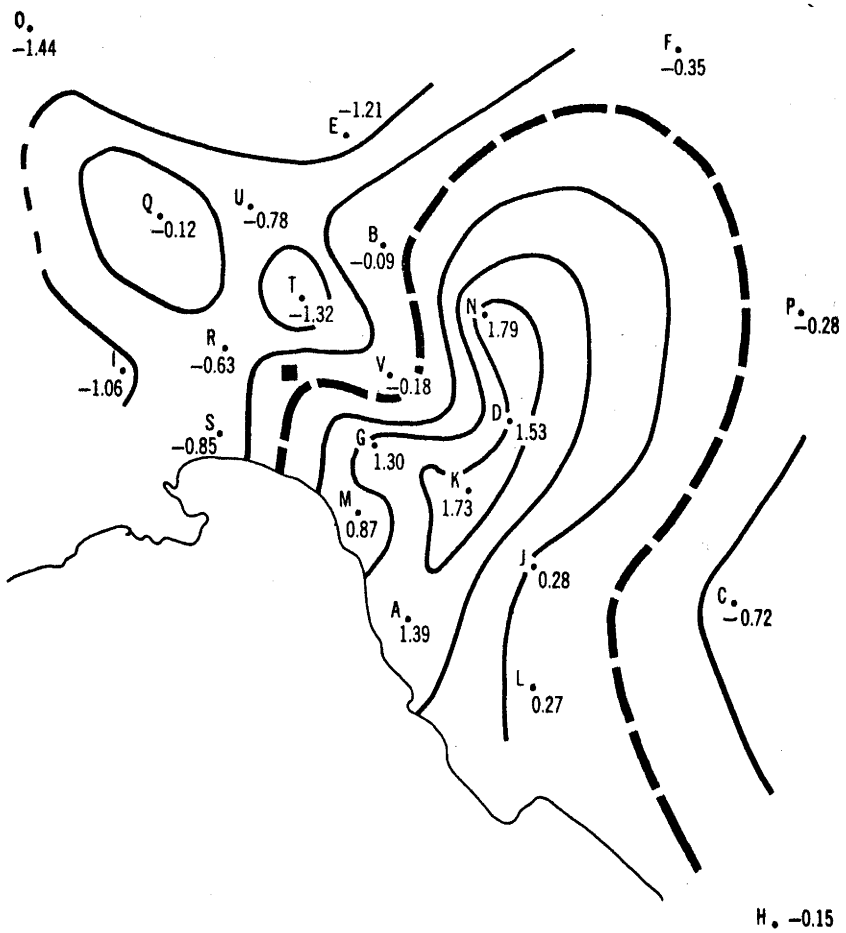

Fig. 10h Socio-economic status (two factor)

the latter being so particularly in Sydney. What the three factor solution does is to isolate two opposite concentric skews - skew towards the inner city for city centrality, and skew towards the outer city for life-cycle stage. From Cox's (1968) study we can expect low participation to be generally associated with life-cycle stage, but upon examining the skew for participation (figures 7b and 8b) we would expect it to be associated in both Australian cities with city centrality. We would further expect the association to be linear but hereroscedastic, i.e. strong in the inner city but weak elsewhere.

d) Comparison of two cities

The two cities are compared using program RELATE[1], and using factors derived from the transformed and from the untransformed variables. Tables 8 and 9 give the results of these comparisons.

(i) transformed variables

Table 8a shows some factor overlap between the two cities (90% for similar factors and 10% for dissimilar factors) for the two factor solution, and table 8b shows the overlap for the three factor solution. For the latter, between-city socio-economic status is more similar (than in the two factor solution) but there is a large overlap between life-cycle stage and city centrality. For the two factor solution the city centrality variables probably account for the overlap, whilst the three factor breakdown shows socio-economic status to be more similar when free of city centrality influence (compare axes plots in appendix G).

Table 9 shows that for the two factor solution the variable with the greatest difference is 'Australian born' (no.6, log difference in transformation) followed by 'House without a car' (no.10, slight log difference), 'Owner occupied house' (no.8, log difference), and 'Masculinity' (no.15, no log difference).

From this comparison it is inferred that firstly the location of variables in relation to factors is not radically different between cities, but secondly that the

location is more different than that for the within-city comparisons (section b above). Although some of the difference could be due to altered distributions, most is probably due to city sociological differences.

(ii) untransformed variables, and comparison

Table 8c shows that for the two factor solution there is less factor overlap when using the untransformed variables, however table 8d shows that for the three factor solution there is more overlap of life-cycle stage and city centrality but less overlap of socio-economic status with itself between cities.

		Melbourne	
		LCS	SO$
Sydney	SO$	.3196	-.9476
	LCS	.9476	.3196

Table 8a. Transformed : two factors

		Melbourne		
		CC	SO$	LCS
Sydney	SO$	.1664	-.9702	-.1763
	LCS	.3813	-.1016	.9188
	CC	-.9093	-.2201	.3531

Table 8b. Transformed : three factors

		Melbourne	
		LCS	SO$
Sydney	SO$	.2702	-.9627
	LCS	.9627	.2707

Table 8c. Untransformed : two factors

		Melbourne		
		CC	SO$	LCS
Sydney	SO$	.1536	-.9760	-.1549
	LCS	.4421	-.0724	.8941
	CC	.8836	.2058	-.4203

Table 8d. Untransformed : three factors

Tables 8 a-d. Correlations between factors between cities, using transformed and untransformed variables.

Var.No.	Transformed		Untransformed	
	II	III	II	III
1.	.9984	.9559	.9809	.9792
2.	1.0000	.9999	1.0000	.9992
3.	.9812	.9444	.9804	.9507
4.	1.0000	.9951	1.0000	.9967
5.	.9811	.9432	.9888	.8339
6.	.9231	.9228	.9092	.9177
7.	.9999	.9980	1.0000	.9868
8.	.9760	.9696	.9814	.9745
9.	.9990	.9691	.9983	.9447
10.	.9583	.9553	.9789	.9709
11.	.9871	.9758	.9961	.9817
12.	1.0000	.9960	.9983	.9783
13.	.9967	.9724	.9957	.8915
14.	.9908	.9585	.9891	.9527
15.	.9722	.9222	.9686	.9058
16.	.9961	.9884	.9953	.9752
17.	.9978	.9958	.9964	.9860

Table 9. Correlations between variables between cities, using transformed and untransformed variables.

Thus transforming the variables cuts out some of the overlap between city centrality and life-cycle stage between cities, but increases the overlap with socio-economic status. This suggests that there are important differences by skews between cities, and when the variables are examined, particularly inner city skews. Including the data skews for both cities allows, at the two factor level of generality, a greater differentation between the concentrically oriented life-cycle stage and the sectorally oriented socio-economic status.

Table 9 shows that for the two factor solution the magnitudes of the variables differences are much the same for the untransformed as for the transformed variables, though no.6 (Australian born) becomes an exception. 'Masculinity' (no.15) and 'House without a car' (no.10) are the next lowest.

For the three factor solution the greatest differences are for 'Female employment' (no.5) and 'Employee' (no.13), followed by 'Masculinity' and 'Australian born'.

For all the comparisons, variables 6, 10 and 15 are consistently different between cities but are less different between factors from transformed and untransformed variables (within cities). Variables 3 and 8 are less different to these between cities, but are still more similar regarding transformations.

Only variables 5 and 13 for the three factor solution show relatively large differences between the transformed and the untransformed variables position. Both have transform differences by city. In Sydney 5 loads upon both life-cycle stage and city centrality, but in Melbourne it loads upon city centrality only. In Sydney 13 loads almost only socio-economic status, but in Melbourne it has a loading also upon city centrality (appendix D). Whilst the alteration of skew could have some affect upon the factoral location of these two variables, one suspects that the two cities differ largely in the social patterning of their inner city areas, and that this is a consequence of the different physical and economic structures of the cities as well as of the more self-generating sociological patterns.

In transforming the variables associated with the city center, the shape of some is altered but the between-city differences are all for approximately normal distributions. On the other hand the between-city differences for the untransformed variables are not due to alteration but are clearly due to the different natural shapes.

In either case there are differences between cities for the same variables, and in particular for those variables associated with the city center. A brief consideration of why this might be follows.

(iii) geographical comparison

Two reasons could explain the city difference, one is measurement error and the other is sociological. Apart from frequency distribution differences, the macro-scale of the electoral divisions might just be too large to accurately reflect the heterogeneity of the city centre. There is little that can be done about this, but the second reason still seems to be a valid possibility.

In looking at the sociological differences, then the physical constraint differences between the two cities seems to be important. Sydney is more spatially constrained by its harbour, rivers and ocean limiting the spatial 'diffusion' of historical growth, and giving less chance for continuous and gentle sociological gradients to develop. In Sydney the CBD is located next to the harbour, and there is a distance of only four or five miles to the eastern land edge and six or seven miles south to Botany Bay. Melbourne does not have these severe constraints to dynamic spatial sociological development (see Johnston, 1966) apart from Port Phillip Bay, and even here the CBD is a couple of miles from the Bay frontage. The Yarra River acts as a sociological barrier (Jones, 1968), but not a very effective one in the lower reaches near the CBD.

It is postulated that the physical constraint differences gave rise to different sociological distributions mainly in the inner city and therefore to the different derived factor patterns from the census data.

This means that whilst the dependent variables are measured identically, the independent sociological variables (factors) are slightly different, and so some between city difference in certain correlation relationships should reflect this. In particular the relationships between some voting variables and life-cycle stage and city centrality from the three factor solutions will vary in an unknown way because of the city differences in their factor structure.

Here city comparisons will be illuminating. All cities are different to some degree, and many social area type studies have the weakness of the single-sample approach.

Therefore the more replication the better, and these studies will contribute to such replication.

For some relationships the city differences will be insignificant, though for these the sample will only be a pair, and still Australia-restricted.

e) Sample bias

In both cities not only is there an increase in areal size of electoral divisions from inner to outer city, but there is an increase in the population and enrolment sizes too. In 1966 this concentric bias was a result of the city growth and internal migration which occurred during the 10 year period since the last boundary redistribution. Consequently the outer city areas are undersampled, and the inner city areas are oversampled. The ratio of the largest (peripheral) to the smallest (inner) divisional enrolment is 3.35 to 1, with the population ratio being only slightly larger.

Because of time limitations, this bias was examined using very similar data for a pilot study of Sydney only.

It has been mentioned in chapter 3 (section 4b) that partialling out size will be inappropriate for the relationships between some variables. For instance when population size and enrolment size were partialled from all possible combinations of the three voting variables, the three social factors, and distance from the CBD, then the only correlations which changed 'significantly' were those between life-cycle stage and city centrality (zero to .50), between life-cycle stage and distance from the CBD (-.770 to -.015), and between life-cycle stage and participation (-.356 to +.270). It is obvious that population size is a surrogate for a more basic dimension such as population density; similar results are obtained when population density is partialled instead of size.

A second attempt to analyse the effects of sample bias entered the values for the peripheral electoral divisions into the data matrix either twice or three times depending upon their magnitudes of the standard score of population size.

		Bias corrected		
		SO$	LCS	CC
Original	SO$	.9991	-.0080	-.0418
	LCS	.0079	1.0000	-.0032
	CC	.0418	.0029	.9991

Table 10a. Correlations between factors from biased and 'unbiassed' data

Var.	r	Var.	r	Var.	r
1.	.9987	7.	.9974	13.	.9936
2.	.9973	8.	.9995	14.	.9931
3.	.9981	9.	.9842	15.	.9956
4.	.9966	10.	.9950	16.	.9962
5.	.9955	11.	.9998	17.	.9925
6.	.9966	12.	.9999		

Table 10b. Correlations between variables from biassed and 'unbiassed' data

This raised the number of cases in the analysis from 26 to 35. The matrix was then factored and the degree of factorial invariance between the two 'samples' examined using program RELATE. The results are listed in tables 10a and 10b for the three factor solution.

The factors are all but identical, as are the variables. The lowest correlation between factors is .9991, whilst that between variables is .9842 for 'persons per dwelling'.

These results suggest that the sample bias in 1966 did not alter the patterns of relationships in the study; this is in line with the observations on index correlation (chapter 3, section 4), and in a much more general sense relates to Dye (1966) who found that electoral bias did not influence policy in the U.S.A.

f) Data discontinuities

There has been concern that ordination cannot adequately handle 'major discontinuities' in the data matrix (Lambert and Dale, 1964; Williams and Lance, 1968; Williams and Lance, 1969), but Noy-Meir (1970) has recently shown that the ordination always reflects the discontinuity and in addition

gives accurate information about the variation on either side of the discontinuity provided that the data has not been 'centered'. Centering shifts the data zero point to a central position, e.g. by subtracting the mean from each value so that the zero point becomes the mean. Standard scores of the form $Z = x - \bar{x} / s$ (chapter 2) are data which have been centered and standardised. These are used in computing r as a part of the usual r formula, and therefore factor analysis using an initial r matrix is based upon centered data.

Ordination, according to Noy-Meir (1970), will still give acceptable results for discontinuous data when centered, but there will be some blurring of structure; rotation will reduce some of the blurring. Obviously the less discontinuity in the data the less an ordination will be affected by centering.

Rather than investigate geographical discontinuities, there is another criterion by which the correlation coefficient is an acceptable base to ordination, and this is consistency. The entire research design for this study is based upon the comparison of standardised profiles by correlation, and this includes the 'predictive' stategy by which voting variables are made dependent upon sociological factors. According to Noy-Meir (1970) this is an acceptable reason for using centered data.

With a small data matrix (and probably little geographical discontinuity), and rotation, the use of the r coefficient as a base to factor analysis probably introduces little blurring of the original data configurations. Other reasons for using it outweigh the probably slight disadvantages owing to centering.

The resulting location of axes in relation to variables is given in appendix G. Little grouping or discontinuity is observed, as far as can be determined by this end-product of method.

Some of the factors are skewed (figures 7 and 8). If there is a trend for variables to cluster in opposite quadrants, it is evident that the 'two' factors are broadly

bi-polar, for example:

Sydney:	SO$ III and CC III	appendix G3
	LCS III and CC III	appendix G4
Melbourne:	CC III and SO$ III	appendix G6
	SO$ III and LCS III	appendix G8

Being in the inner city, and generally of low socio-economic status, 'city centrality' joins the other two factors, producing this very broad bipolarity. In Melbourne there is an additional broad polarity between socio-economic status and life-cycle stage, the latter (three factor) being a complex skewed distribution in which the high values are located in the middle concentric zone (neither inner nor outer city).

g) Outcome

Seventeen census variables were transformed and factored, and both the two and three factor solutions were accepted for use in further analysis. Varimax factor scores were obtained for each electoral division for each factor, and were used as sociological variables in correlation and grouping with voting variables.

3. Classification

The method used in this thesis gives an heirarchy of exclusive regional classes, and is used because parts of the research design require discrete classes rather than the continuous distributions given by factor analysis. There is an extremely wide variety of classification methods to choose from, and so any choice must be explained clearly (see figure 11). The type chosen for this thesis uses the squared Euclidian distance as similarity coefficient and minimises the mean within-group variance, taking the whole new group variance as criterion rather than simply the heirarchical variance gain. The reasons for these choices are given below.

The classification is extrinsic rather than intrinsic, that is the purpose is to discriminate external variables rather than to sort an underlying generative system (Williams 1967).

a) heirarchical

The reason for choosing an heirarchical method is simply that the design requires an heirarchy. Flexibility of choice in selecting the size of regional groupings is essential for the regional contagion method (chapter 6); city patterns (chapter 7) can also be analysed explicitly by scale. Heirarchical methods firstly maximise the heirarchical route, then give the most homogenous groups (Lambert and Dale, 1964; Spence and Taylor, 1970; Williams and Dale, 1965). Given the small data matrices used (26 x 3 being the largest) then it is doubtful that the classes derived from the heirarchical method would be much different to those obtained by non-heirarchical methods (which give optimum groupings irrespective of heirarchical route).

b) polythetic agglomerative

Given interval-scale data with an heirarchical method, then a polythetic agglomerative technique (rather than monothetic divisive) is the only type possible at the next level of choice. Until very recently the monothetic techniques could handle only binary data (Lance and Williams, 1965, 1968, 1971; Macnaughton-Smith, 1965).

Having got this far with choice, there remains an array of fusion strategies and similarity coefficients to choose from. Also there are the choices of heirarchical maximisation and of fusion restriction.

c) fusion strategy

Fusion strategies can be classed into single or multiple link types. In the former, two groups are fused according to some value (e.g. minimum distance) between any one member of one group and any one member of the other group. Multiple link strategies typically take the values for the whole of each group (e.g. the centroid; the sum of squares) and then use these group measures to get a measure of similarity.

Williams, Lambert and Lance (1966) compared the nearest neighbour (single link) and centroid strategies, and found that the latter gave a better heirarchical

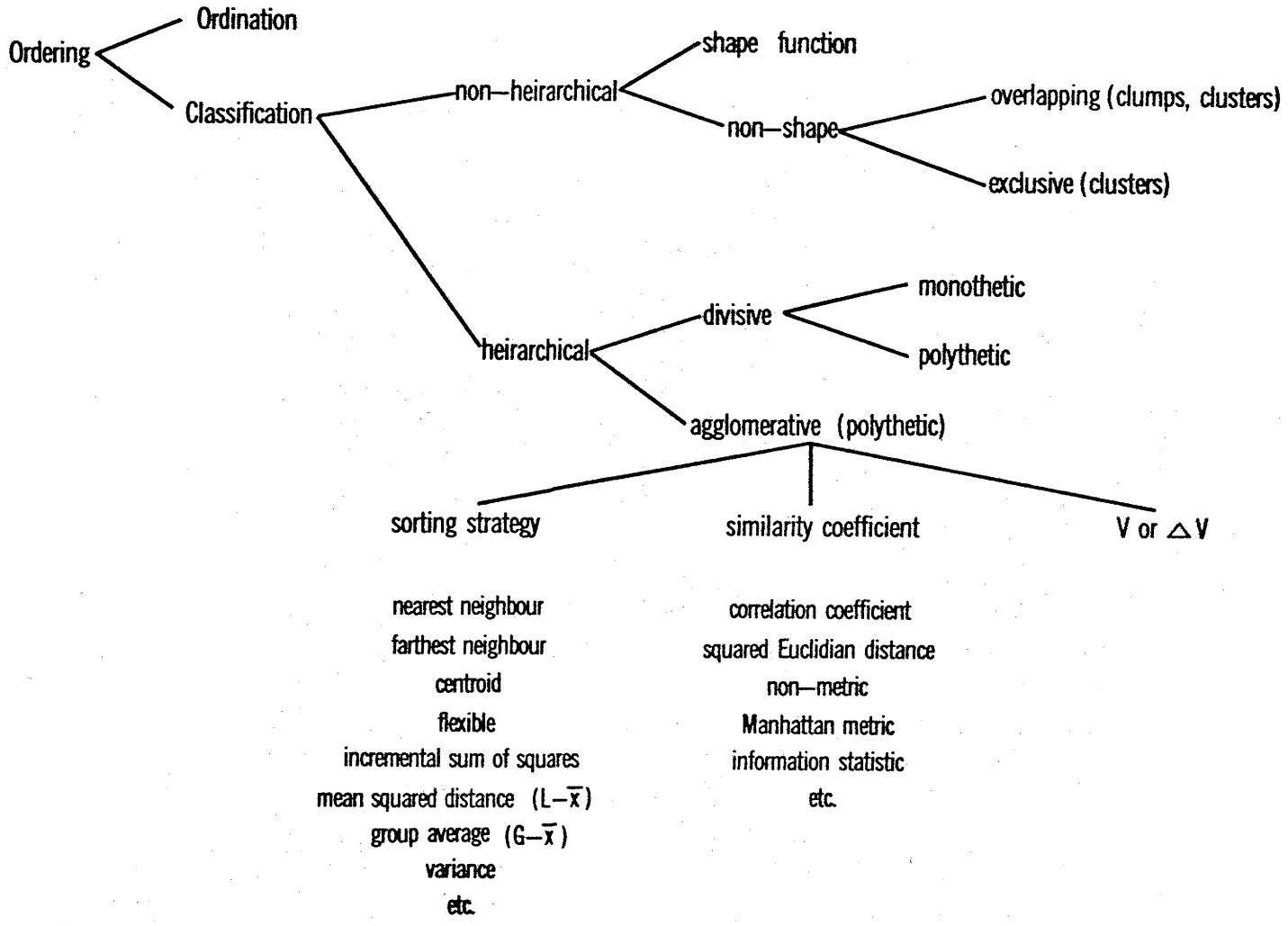

Figure 11. Classification of some methods of classification

grouping. The single link method is too subject to 'chaining', a phenomenon in which a given group grows by the addition of single individuals (or very small groups) rather than by fusion with other groups of comparable size. Their study emphasised the superiority of multiple link strategies for general purposes, and for when a clear-cut heirarchy with little chaining is required.

A multiple link strategy is used in this thesis, but one which manipulates group variance. This is because the classification is extrinsic, and therefore its purpose is to match the variance of dependent variables with the variance of the grouped independent variables. The method used is not the classical centroid but instead simply takes the variance values of groups as criteria for fusion (Burr, 1968, 1970; Williams, Clifford and Lance, 1971). It is detailed in section (e) below.

d) similarity coefficient

The choice here is broadly between the correlation coefficient, the squared Euclidian distance, and a variety of other 'metrics'. The correlation coefficient was not used because of the small number of variables used in classifying. The squared Euclidian distance is compatible over most fusion strategies (Lance and Williams 1967a), whilst the other metrics tend to have particular uses or restricted compatabilities rather than general uses and compatabilities (Lance and Williams 1967b). The squared Euclidian distance is used as the basis for the variance fusion strategies used in grouping (Williams, Clifford and Lance, 1971). With some fusion strategies the squared Euclidian distance can have a failure of the monotonicity of heirarchical variance gain, and it can sometimes be subject to unwanted chaining (Lance and Williams, 1966; Williams, Lambert and Lance, 1966). These effects did not apply for the data in this thesis.

e) methods used

The first step is to compute a matrix of similarity measures between each and every electoral division (divisions are henceforth referred to as 'individuals'). If only one

variable is used in grouping, the similarity measure is simply the square of its difference between individuals. If more than one variable is used then the similarity measure is the sum of the squared differences for each variable (using only standardised data). All grouping then proceeds from this initial similarity matrix, the first pairing being selected by taking the lowest value in the matrix.

Upon fusion a new value is computed for the new group and (in general) for its similarity with any other individual or group.

Three variance fusion types are considered:

(i) Total squares

In grouping together A, B, and C, then the similarity values AB, AC, BC, are summed only, giving the total variance. This can be viewed as the group mean (below) weighted by group number.

(ii) Group mean

As for total squares, but the sum is divided by the group number (in this case 3). When two groups of sizes n = 2 and n = 6 fuse, then the new group variance is divided by n = 8.

(iii) Linkage mean

As for total squares, but when two groups fuse the new group variance is divided by the number of between-groups links, i.e. the product of group numbers. For groups of sizes n = 2 and n = 6, the divisor is n = 12.

The total squares fusion gave acceptable synoptic[1] groupings, but the weighting by group size appeared to be inappropriate at very high levels. Using the group mean overcame the latter difficulty whilst giving practically the same groupings in all other respects. This method is commonly used (Veldman, 1967; Burr, 1970) and although extensive comparisons with other methods have not been made, gives numerically and aljebraicly acceptable results.

1. Broad group similarities are of interest rather than accurate ascription (Williams et al, 1971).

Probably the best way to understand the linkage mean strategy is to assume a theoretical base of field forces or potentials in either the geographical space or the hyperspace. The complete heirarchy then represents a sub-optimal but complete linkage between each and every individual. For this thesis the method clearly picks out those regional nodes which are focal points within their regions. It is probably the breaks in 'distances' between values in attribute distributions, e.g. skews and embedded isolates, which make the field force analogy appropriate. The method has been examined by Lance and Williams (1967) and Williams, Clifford and Lance (1971), and whilst it has not been possible yet to use the aljebra of field forces rigorously within the method, there are no major objections to it. Its sensitivity to aberrant data configurations (Williams et al, 1971) can be a benefit in some circumstances.

Another consideration of method is whether to use either the complete variance value or the variance gain for the new group as fusion criterion. For instance in fusing groups {ABC} and {DE}, then for the complete variance, V, and the variance gain, ΔV,

$$V = V_{\{ABCDE\}}$$

$$\Delta V = V_{\{ABCDE\}} - V_{\{ABC\}} - V_{\{DE\}}$$

(these are equivalent to I and ΔI in information statistic symbols, see Lance and Williams, 1966).

The variance gain criterion gives the only logically correct path through the heirarchy, but using the complete variance criterion, although logically incorrect, will probably not be numerically inadequate when using a small data set[2] (see also Williams, Lance, Dale and Clifford, 1971). There were two reasons for choosing V over ΔV, and these were (i) that the whole group variance is being considered, and therefore an attempt is being made to firstly maximise group homogeneity at every level of the

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[2]. Dr. W.T. Williams, C.S.I.R.O., personal communication. The author's data set was considered to be very small.

heirarchy (in preference to firstly maximising the heirarchical route), and therefore this is more appropriate for extrinsic classification, (ii) that the groupings derived using V were intuitively better than those obtained using ΔV.

The tests for (ii) covered many logical combinations and the output was voluminous and difficult to present concisely. Therefore the comparisons have been left out of the thesis and the justifications for using V stands as otherwise given in this section.

A final consideration is in the use of directly restricted fusion, i.e. the contiguity constraint. Obviously if a research design demands contiguous grouping to discrete regions, then a method to do this must be designed; there is nothing intrinsically 'right or wrong' about directly restricted fusion (See Johnston, 1970; Spence and Taylor, 1970). When within-region spatial diffusion is postulated then exclusive regional sets are required. The regions are then functional in that the function is specifically a spatial contiguity diffusion function. For extrinsic regional classifications the variance of a dependent variable can be related to the classes in exactly the same way as it is for non-regional ('open spaces') groupings.

Consequently the contiguity constraint was used, using the connectivity of figures 1b and 2b. Two groups could fuse if any member of one group was contiguous with any member of the other group.

f) similarity hyperspace

> ...the chief source of erroneous conception is that a conception, once quite correct, gets out of date and inaccurate owing to an unheeded change in the cluster or in the available knowledge concerning it.
>
> (Gasking, 1960, p.19)

Pocock and Wishart (1969) have drawn attention to the choice between methods grouping by spheroidal and elongated clusters in the attribute space. Any method will group by spheroidal clusters if they exist, but only some will group

by elongated patterns of clusters if they exist.

In general the problems of similarity groupings are firstly in the choice of the method of fusing individuals within these clusters, and secondly in the choice of the method of allocating inter-cluster individuals. The latter individuals may form a group of their own, or be 'chained' one at a time to existing cluster groups, or they may form subgroups which gradually amalgamate with other groups. Both choices are interdependent and demand a knowledge of the (geographical) system being analysed, the methods used, and the type of results required. In research the geogrphical system is usually imperfectly understood,and there is a paucity of comparative studies to guide in the choice of methods.

If the data is geographically based, then classes (or factors) derived and represented in hyperspace (axes space) must have a geographical space differentiation. But it does not follow that a cluster in hyperspace represents a region or a node in geographical space, even though the axes in hyperspace may approximately reflect some spatial dimensions such as distance from the CBD, sectoralism, etc. The meaning of the terms 'core' and 'transition zone' when used in the hyperspace (Johnston, 1968; Stimson, 1970) should be distinguished from their traditional geographical meaning. The hyperspace core is one of similarity, whereas the geographical core is one of density or magnitude. In the latter case the core variables are of the same type as the surrounding region but of greater magnitude (some different types may be present in addition). Because of the very difference of its 'peak' densities, the geographical node will usually be located away from its regional cluster in the hyperspace (there may be one or a number of 'core' points in the hyperspace depending on sampling; the degree of 'elongation' of the cluster, or the degree of attachment of the 'node' to its regional cluster in hyperspace will vary also according to sampling as well as to the actual geographical distribution).

Being an isolate in hyperspace, methods can either separate the geographical node from or embed it within its geographical region. The 'cluster shape' methods (Pocock and Wishart, 1969; Spence and Taylor, 1970) may or may not do this, but have a greater probability of doing it than have ordinary non-shape clustering types. However, simply using a contiguity constraint with a non-shape method (as in this thesis) will always embed the node within its region. It may be fused relatively late in the heirarchy, but by then there usually is little doubt as to what function it has in relation to its surrounding region.

On the other hand, the densest part of a simple similarity cluster when mapped in geographical space, may be that part of a single or multiple density surface which flattens out around the nodal peak, and so similar classes may be mapped as geographical rings or zones around the node.

Choice of method depends upon purpose, and the method of non-shape clustering plus contiguity used in this thesis serves the purpose of giving adequate similarity regions. The philosophy of what is a 'real' cluster, and what is a 'better' cluster and why, etc., has been tackled by Gasking (1960), and he notes that all cluster conceptions can have basic error elements, but that they can be used successfully if there is some empirical knowledge of real world (geographical) 'clusters'. In other words the use of a cluster concept (method) should be neither pre-conceived nor tautological, but heuristic.

4. Classification of factor scores and voting variables

It has been claimed by Pocock and Wishart (1969) that components (unrotated) rather than varimax (rotated) scores should be used in classification. Their observations that the initial similarity matrix is identical for either type of score when a few factors are extracted is correct (and therefore the difference is of little concern for this thesis), but for more factors their assumption is that every variable is of equal importance. The reason for rotating includes an assumption that every variable is not of equal importance however, and so whether one uses one

type of score or the other again depends upon the purpose of the research. Varimax scores are used where syndromes are needed and where the remaining variance is considered unimportant, and typically is used where classification is not the sole aim of research. This is the case for this thesis.

In obtaining factor regions by classification, the distribution of the voting variables can then be examined across the regions. Similarly, if the method demands it, voting regions can be derived and their sociological composition examined.

Section three: Products of method

> But let us go into this thing with our eyes open. Let us taste beforehand the flavour of what is to come. The situation is much as if a child had long been asking us an age-old question, seeking to learn the truth.
>
> 'Daddy,' she says, 'which came first, the chicken or the egg?'
>
> Steadfastly, even desperately, we have been refusing to commit ourselves. But our questioner is insistent. The truth alone will satisfy her. Nothing less. At long last we gather up courage and issue our solemn pronouncement on the subject:
>
> 'Yes!'
>
> So it is here.
>
> 'Daddy, is it a wave or a particle?'
>
> 'Yes.'
>
> 'Daddy, is the electron here or is it there?'
>
> 'Yes.'
>
> 'Daddy, do scientists really know what they are talking about?'
>
> 'Yes!'
>
> \- Hoffmann, The strange story of the quantum

The testy ambiguity of the scientist's dilemma is captured fully in this section.

In the crucial analysis of the original findings we find that two types of relationship are possible, we also find that a number of variables could account for the same patterns. Not content with this there are varieties of logical perspectives - deductive and inductive, inferential and suggestive, not only in this study but also in some published studies upon which it was hoped a theory could be built. And as for causality - is there diffusion or demographic selection or both or....what?

And so on.

However some possibilities are considered, and it is hoped that the suggestions developed from this study will prove fruitful for the next desperate scientist who attempts to answer those insistent questions.

CHAPTER VI

REGIONAL CONTAGION AND THE PARTY VOTE

From figures 9a, g, e, and 10a, f, h, it can be seen that both %ALP and socio-economic status have what can be crudely described as a sectoral distribution in the two cities. Using socio-economic status from the two factor solution, the correlation between it and %ALP is r = .898 in Sydney, and r = .796 in Melbourne. There is little that is unexpected in this simple relationship, but if the residual from the correlation is obtained, using the regression transformation with %ALP as the dependent variable, then it is apparent that this residual has some very interesting relationships with socio-economic status and some other variables.

On mapping the residual for the two cities it was noticed that its values decreased with distance from the status nodes in high status areas, and increased with distance from the nodes in low status areas (figures 12a, b). This regularity suggested a social distance or contagion effect, and so a method was designed to measure it. In order to clarify what is being measured, some of the methods and findings of ecological studies in political sociology and human geography are recounted.

1. Readings

The effect of the social aggregate upon voting behaviour has been analysed by Scheuch (1969) for Germany, and he found that the smaller and more homogeneous the community, the more the vote became a confirmation of the voters belongingness to the community. In larger scale communities, e.g. in city suburbs, then voting is by antagonistic quasi-group membership.

Ennis (1962) found that for four sample states in the U.S.A., that as the scale of the community increased from rural to small town to city, then the contextual (or ecological) influence upon party vote changed in predominance from the traditional factors of religion, ethnicity,

and headship influence, to social class. The attitudes and voting of individuals was shown to differ according to whether they lived within a region predominantly of their own or of the opposition party (though this could have been a function of demographic survival of the fittest rather than of direct influence). Differences were evident in the degree of the effect upon behaviour of living in the opposition party region, the Republicans being less prone to change or influence than the Democrats. This suggests behaviour differences by party affiliation. Issues were also found to interact with social context in influencing the vote; some differences in the perception of the importance of different issues existed between the supporters of different parties.

Both Segal and Meyer (1969) and Putnam (1966) have demonstrated the effect of the neighbourhood socio-economic status upon the individual party vote[1], and both have investigated the various possible reasons for this. Segal and Meyer have also illustrated, by using a probability model, that the effect of increasing the average socio-economic status in a neighbourhood should be to increase the probability that primary groups (here of 3 and 5 persons) will have a Republican majority above and beyond the proportion accounted for by socio-economic status. The same effect is observed for low status areas and a Democratic majority. If the socio-economic status of neighbourhoods is plotted against their probability of primary groups having a Republican majority, the lines do not match, but are similar to the regression slope . comparisons between individual and aggregate data defined by Valkonen (1969,p.60) and Duncan et al (1961, p.123). The slope for the group probabilities, or for aggregate data, is accentuated, indicating an extra ecological effect in the relationship between X and Y. Thus there are more Republican voters than expected according to socio-economic status in high status regions, and fewer than expected in low status regions.

1.There are some doubtful methodological assumptions by Putnam, such as uncritical grouping by the dependent variable, but the general trend of his findings is in accord with other theory.

The processes of ecological influence and contagion of voting behaviour, and of the various possible reasons for this have been examined by Butler and Stokes (1969) and McPhee and Ferguson (1962). The 'immunization' theory developed by the latter pair contends that when partisanship is new, then electors will always be susceptible to change by contagion, but as partisanship ages, then the electors become immunized to change, to new ideas, or to contagion. The primary consideration of the immunization theory is that the uncommitted voter - usually the younger one - is more likely to vote according to the trends and issues of the day; as he ages he settles for a particular party and is consequently less variable in his voting. It is the personal political decisions required by voting which create his eventual immunization to subsequent political trends. The second consideration is that the less immunized voter is likely to be more influenced by his social environment.

Because voting is compulsory in Australia, and because there tend to be quite a few elections in a short period of time when compared to other Western countries[2], one would expect immunization to occur at a much earlier age for the Australian elector. Age would therefore be comparatively less important in analysis, though it should be incorporated nevertheless.

What most of the references bring to light is a form of group-anchoring of the party vote. The class milieu (residential and other social) influences the voting of the individuals in such a way that voting swings are dampened over time, and so that voting behaviour is smoothed over neighbourhoods. Because the geographical pattern of residential socio-economic status is slow in changing, the nett result is a stabilisation of voting patterns over space and time as a result of social ecological functions. Whilst some of these functions may be aspatial, some will certainly be functions of (spatial) residential social status.

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2. Rydon (1963, p.176) recalls that there has been an election on average once a year in N.S.W. since 1949, apart from local government elections and by-elections.

The pattern of ALP residuals (i.e. the remaining ALP vote after the variance directly due to socio-economic status has been subtracted) suggested that much of the remaining ALP vote could be described by a spatial function of the residential status pattern. The analysis was consequently designed to measure this.

There is no known literature to date on the form of the hypothesised regional contagion effect suggested by the residuals, namely that the influence increases with distance from the node within city regions. There are a number of studies demonstrating the reverse for non-city study areas, i.e. that a particular political influence decreases with distance from the node, and these fall generally into distance decay type studies (McCarty, 1952; Roberts and Rummage, 1965; Reynolds, 1969). In the absence of previous studies, the method of analysis and its interpretations were developed entirely by the author.

2. Hypotheses

The hypothesis developed from the readings and from the mapping of residuals is that a regional contagion effect exists which is dependent upon the geographical pattern of socio-economic status, and which explains most of the remaining ALP variance.

The hypothesised form that the regional contagion takes is that voting for a region's major party is greater than the expectation based directly upon socio-economic status as one moves from the node to the periphery of a region.

In other words it is hypothesised that the pattern of the ALP vote is explained by the pattern of two variables, socio-economic status and regional contagion, the latter being dependent upon the former.

3. Development of the regions

In order to measure the regional contagion effect an identification of the nodes and boundaries of city regions is required. Here we strike a methodological problem: the effect of regional contagion, although dependent upon socio-economic status, is hypothesised to be above and beyond

that of socio-economic status. Delimiting regions by socio-economic status alone will therefore not account for the additional influence of regional contagion; a method is required which will delimit regions according to both socio-economic status and regional contagion.

The form of the second variable is not known however, and so one must move from a predictive, hypothesis testing methodology to a deductive hypothesis generating methodology. If it is assumed that the ALP distribution contains the influence of both socio-economic status and regional contagion,plus error, then the ALP regions will delimit their combined effects.

The argument is circular, but if used with caution, will help towards a deductive geographical delimitation of the influence of regional contagion. The hypothesis about regional contagion cannot be directly tested because the method is deductive from the dependent variable. As shown below, however, the pattern created is so strong that one would expect the effect to exist in reality. The method is however logically a hypothesis generating method, and these hypotheses should then be examined either theoretically, or quantitatively by using new data. Although the term 'predicts' is used in subsequent correlation analysis it should be understood that it is meant only within the limits of a deductive methodology.

The regions were defined therefore by using %ALP values in the minimum variance regional grouping method. Regional heirarchies for both cities were obtained this way. Differences in classification according to different strategies are often of diagnostic importance in themselves, but for the purpose of ALP regionalism, the aims are clear: to obtain a mean similarity of areas with a minimum of internal regional variance. Given the small data set, then using the variance as against the variance gain method, and using the group-mean fusion strategy is most appropriate (chapter 5, section e).

Because socio-economic status is taken to be the basis of party affiliation, and the basis of regional contagion, the node of any region was taken to be the most extreme

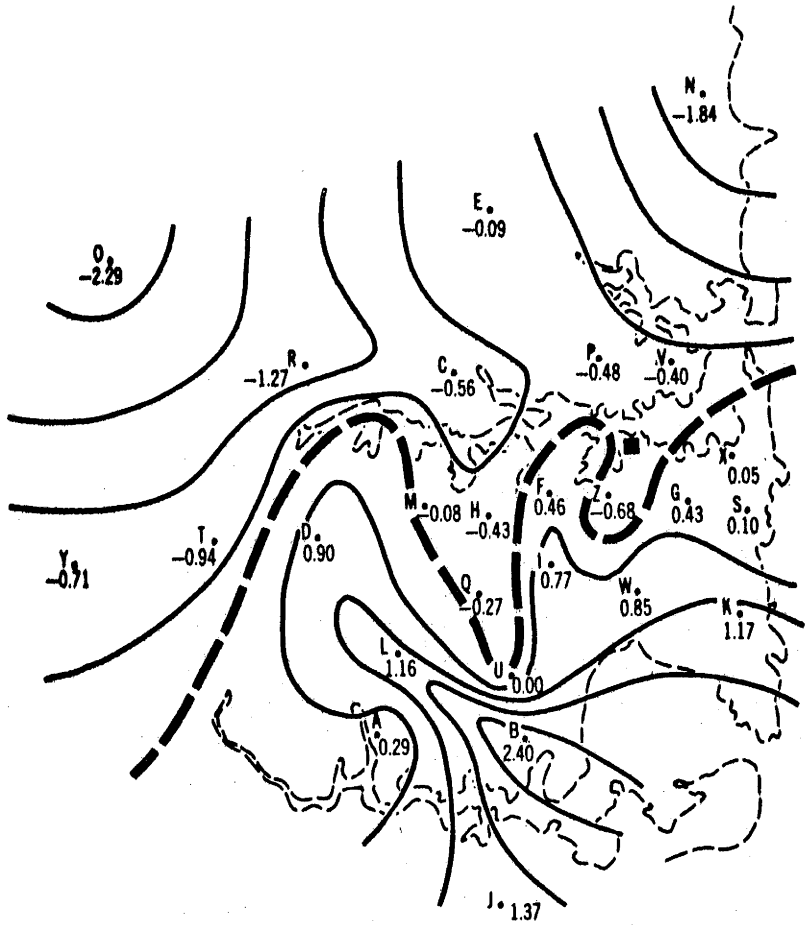

Fig. 12a. ALP residual from socio—economic status

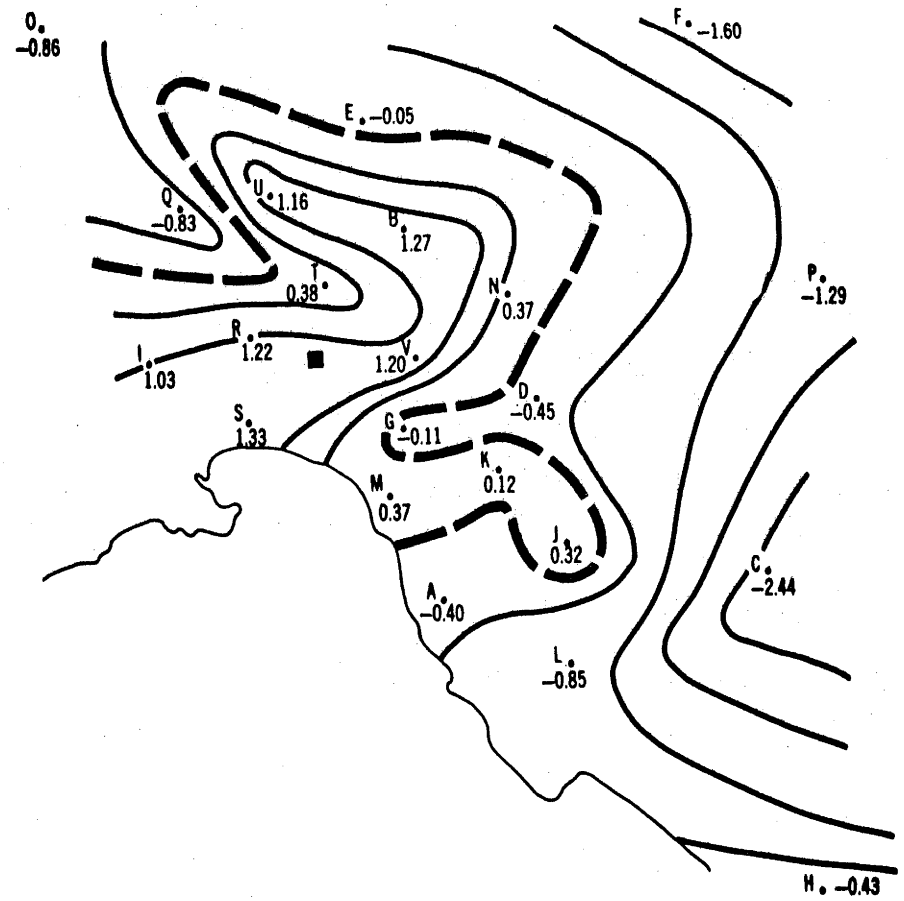

Fig. 12b. ALP residual from socio—economic status

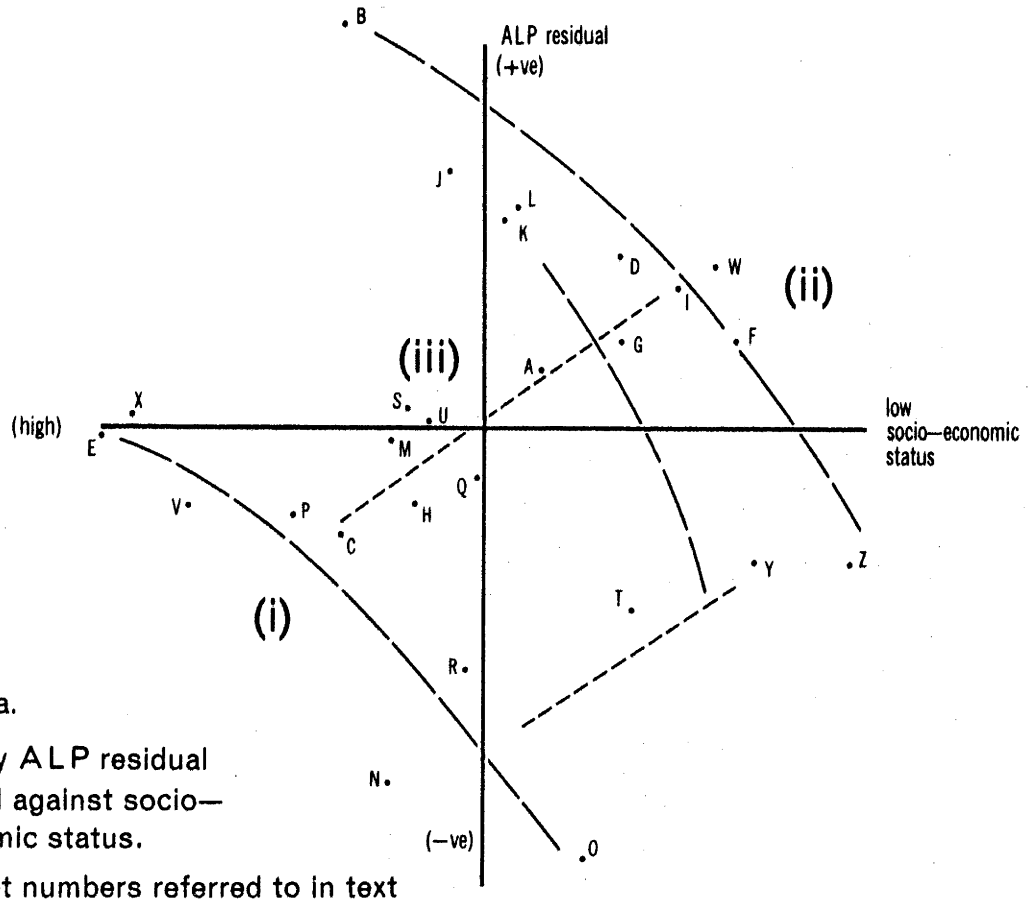

Fig. 13a.

Sydney ALP residual plotted against socio—economic status.

Bracket numbers referred to in text

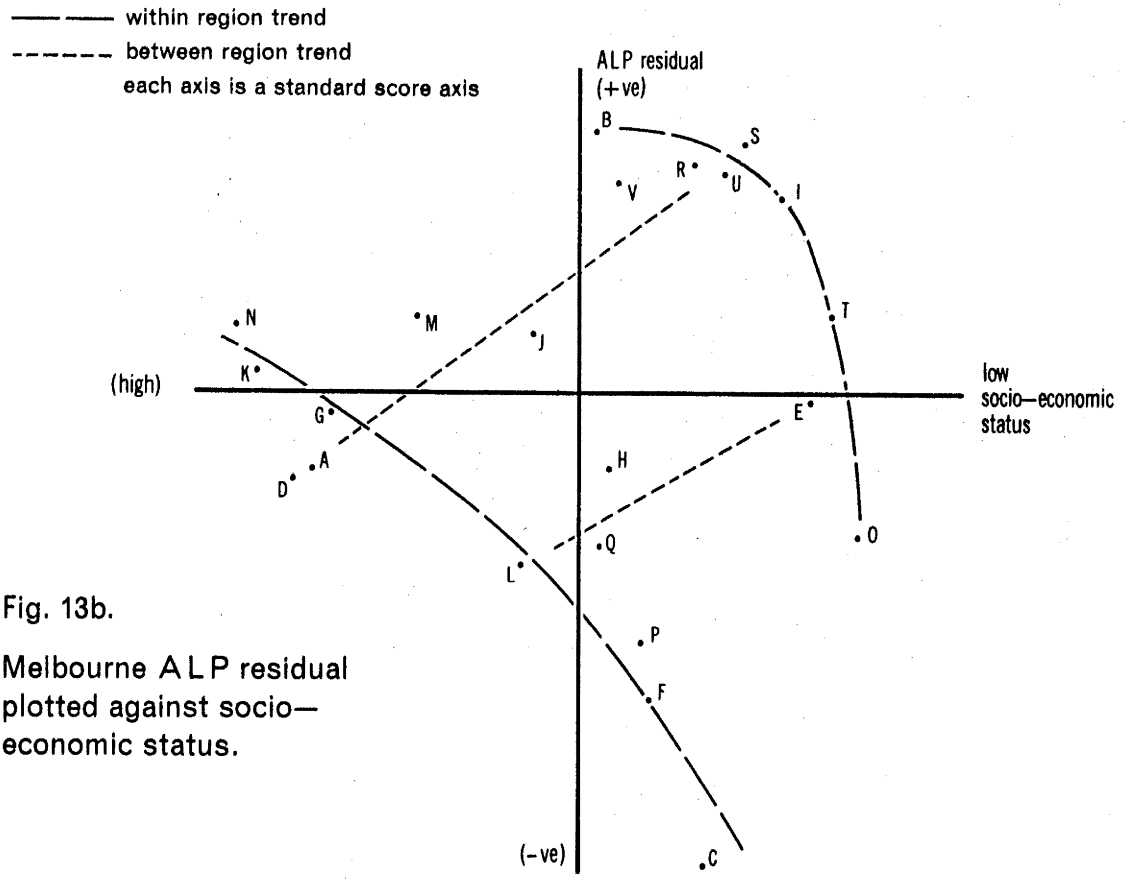

Fig. 13b.

Melbourne ALP residual plotted against socio—economic status.

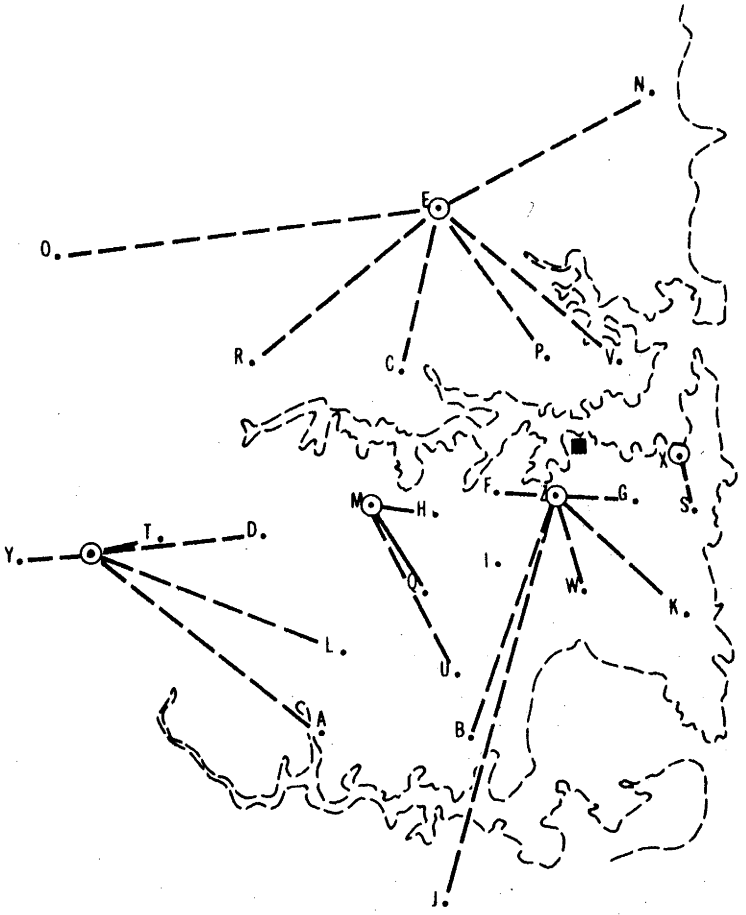

Fig. 14a. Nodes and regions accepted for contagion measurement

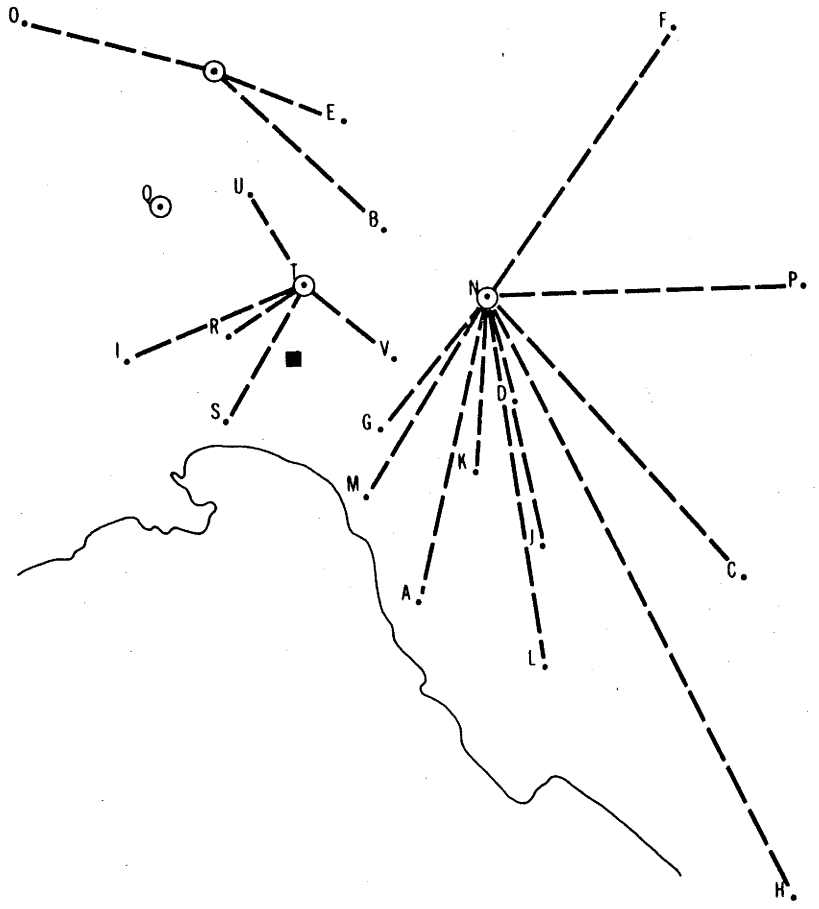

Fig. 14b. Nodes and regions accepted for contagion measurement

value of socio-economic status in the region, that is, the highest or the lowest depending on whether the regional values were above or below the mean.

4. Selection of regions

Having obtained an heirarchy of regions, the next step is to determine which level should be used in analysis. Here the second component of the deductive method is introduced.

If the ALP residual is plotted against socio-economic status, distinct subpopulation linear trends are defined (figures 13a and 13b). Some of these appear to be curvilinear, but all will be approximated by straight line measurement. The axes plot gives trends which, when compared with the map of socio-economic status pattern, are clearly of both geographical and social distance. For instance the plot for Sydney gives a tilted-H distribution, with three major trends (figure 13a). The three trends are:
(i) Both E and X are regional high status nodes at the mean of the residual. From the high node, then as socio-economic status lessens, electorates vote more non-ALP than expected. X is regionally isolated and S is discussed below; the pattern is mainly one of the northern suburbs.
(ii) Two low status regional nodes, Z and YT, are located just below the residual mean, but as socio-economic status increases, then electorates vote more for the ALP than expected. Geographically the two regions form a V-shape, joining at B and J (figure 12a), though they both form the same sort of linear trend on the plot.
(iii) The remaining electorates which do not fit in with either trend cluster around the mean of both axes. Geographically they form a single intermediate region (MHQU), plus S. In both Sydney and Melbourne, the linear trends in opposite direction to the major intra-regional trends are in general inter-regional trends, and are discussed in section 11 below.

The final pattern of regions chosen is made with the aid of the axes plot, for it defines the limits of the bivariate sub-population trends. The heirarchical level

to be used is determined by matching the regional membership at each heirarchical level with the composition of the linear trends on the plot.

For example the outer eastern suburbs of Melbourne form a separate region at one level, but are joined to the inner eastern suburbs at the next level. The axes plot (figure 13b) shows them both to be clearly part of a linear geographical and socio-economic trend which includes both inner and outer eastern suburbs, and so they are treated as being part of the same contagion region.

An exception to the method of identifying nodes is when a large and heterogeneous electorate on the periphery of the city is the logical choice. Because of the heterogeneity and the great size of these electorates, it was thought that the node would be best represented by taking the mean between it and the nearest contiguous socio-economic value, provided that the latter was close, and provided therefore that the result acceptably approximated nodal continuity between the two electorates. For Sydney Y and T, and for Melbourne O and E were treated this way.

Only one departure from the ALP grouping was made; in Sydney the divisions B and J in the southern suburbs are not connected by contiguity to the central city (ALP voting) electorates, but are connected to the inner western and outer western electorates. They were logically grouped with the YT rather than the Z nodal region, but a knowledge of city transport patterns indicates that connectivity of B and J is predominantly with Z rather than with YT. By the axes plot it matters little which node is taken as influential, and by actual measurement the difference was also slight. Because any direction of influence is almost certain to follow the main arterial links to the city center, and because contiguity with the city centre is only broken for a short distance (see the boundaries of W, U, and B, figure 1a), then Z was taken as being the nodal influence for B and J. The change is minor: quite similar results are obtained whether YT or Z are used as node for B and J.

The final regions and nodes adopted are shown in figures 14a and 14b.

5. Measurement

If the regional effect is to be zero at the node, then the nodal value of the regional contagion measure should be zero. The nodes are empirically close to the zero mean on the residuals axis, and so it is both empirically and theoretically appropriate that zero values should be allocated.

There are, however, a number of ways in which the regional distance from the node can be measured. One can use the geographical or the social distance, and one can use a weighted or an unweighted node. The geographical distance is the simple linear distance between the population centers (the points used in the base maps), and the social distance is the difference between an electorate's socio-economic status value and that of the node. The latter values will be signed according to whether the regional status is above or below the mean. Weighting is theoretically justified if the more extreme status regions are assumed to have a greater contagion influence, and it is done by multiplying the distance values by the absolute value of socio-economic status at the node.

The four measurement possibilities listed above were obtained for Sydney and correlated with the ALP residual. The results are given below:

	unweighted	weighted
geographical distance	.8394	.8733
social distance	.8927	.8960

Overall there is little difference between any of the measures. Although the weighted measures give slightly better results, they were not used in subsequent analysis because of a desire to keep the method as simple as possible. In the analysis above, geographical distance values were given the same sign as social distance values. The rationale for this, and the comparison with social distance is given in section 8 below.

6. 'Deviant' electoral divisions

Both the axes plot and the heirarchical groupings reveal a number of electoral divisions which deviate from the expected patterns. On the plot they do not appear to conform to any linear trend, whilst in the heirarchical groupings they are isolates until rather late in the heirarchy.

In Melbourne they are located at the borders between groups, but are either values inbetween those of the two groups, as with M, or are at distinct variance with both groups, as with J or Q, or are peripheral units such as O and H. Unusual discrepancies with the surrounding areas should be investigated for error or other reasons for their difference. Normally, if a regional discrepancy cannot be explained by specific variables, then using the analogy of field forces, there should be considerable sociological tension between it and its surroundings, thereby making it relatively unstable.

Sydney has only two isolates by heirarchical grouping (X and S), and only five which are close to the origin of both axes on the plot (MHQUS). X and S are discussed below, and the other four form a single region of secondary high socio-economic status.

It can be seen from table 11 that in Melbourne, Q is isolated at very high levels and as such should be a single member region of its own (assigned zero on the contagion measure). V forms a single-individual region for socio-economic status but not for party vote (i.e. when there is assumed to be no contiguity with B). The surprising difference between Q and V is that although V lies between a high and a low socio-economic status area, it has a high %ALP vote, whilst Q, surrounded by low socio-economic status areas, has a medium-low %ALP vote.

In Sydney, S and X join to form a two-member region, but there is obviously a big difference between them in socio-economic status.

	Melbourne				Sydney			
	ALP		SO$		ALP		SO$	
H	L-$\bar{x}$	G-$\bar{x}$	L-$\bar{x}$	G-$\bar{x}$	L-$\bar{x}$	G-$\bar{x}$	L-$\bar{x}$	G-$\bar{x}$
2.			T				X	
3.	Q	Q						
4.	J			Q	S,X			
5.	H		Q	V				
6.	M	J						X
7.		M	V			S,X	E	
8.	V	H						
9.		V		T	E		Z	E
10.	O		H	H	V			Z

INDEX : SO$ = socio-economic status H = heirarchical level
L-$\bar{x}$ = linkage mean G-$\bar{x}$ = group mean

Table 11. The location of isolates in the grouping heirarchies

In comparing cities it is noticed that there is a more complex paytern of primary and secondary social status/ALP regions, and of isolates in Melbourne. The city sociological differences are discussed in chapter 5, section d, but discussion of the voting differences follow.

The primary regions are similar in regularity and geographical gradients except for the irregular geographical pattern of both low socio-economic status and high %ALP vote in Melbourne. The fact that an isolate, Q, is surrounded by high ALP areas but is relatively unaffected by them warrants a closer investigation.

Secondary regions also follow a slightly different pattern with there being more 'capture' of secondary low socio-economic status areas in Melbourne by the Liberals, i.e. F, P, C, and H each have much higher than expectation non-ALP votes on the basis of direct socio-economic status. The ALP captured only B and V there, the latter having some isolate status for socio-economic status. The notable equivalents for Sydney are O and R captured by the Liberals, and B and J by the ALP.

One reason for these 'capture' differences between cities is likely to be the physical and zoning constraints to expansion which prevent an outward spread (to the north and northwest) from the high socio-economic status region

in northern Sydney; Melbourne does not have this type of severe constraint. Other explanations include the possibility of a greater sociological importance of high socio-economic status in Melbourne, and also the fact that F, P, C, and H there are large heterogeneous peripheral units with rapid electoral growth and with possibly an upwardly mobile electorate in terms of socio-economic status. They are likely to be electorates with more young families, and therefore possibly are more flexible in terms of affiliation, though this is a supposition only, no analysis of the location of young-age groups of voters having been made.

In Sydney X is physically constrained between the Pacific Ocean, Sydney Harbour, and the CBD, and S between the Ocean and X, taking in the southern beach fringe. S includes parts of the high status region of X, but is also a high density flatting area with corresponding social status and demographic extremes. Both have a high proportion of Sydney's Jewish population, which traditionally votes for the ALP. Taft and Goldlust (1970) have analysed the political preferences of Australian born and immigrant refugee Jews in Melbourne. The immigrants comprised nearly 60% of their sample and were mainly 'middle class'. Although most of the Australian born Jews preferred the Liberal Party, most of the immigrant Jews preferred the ALP: "a great majority of the refugees have reached middle-class economic level, yet the majority still maintain support for the Labour Party often against apparent vested interests" (p.36). There is probably a similar bias towards the ALP in Sydney. The latter would help account for the anomalous %ALP vote, especially in S.

The major Melbourne isolate, Q, is an area of secondary low socio-economic status and secondary high non-ALP vote, and is an area of old established homes (as M in Sydney) plus new developments. Because it is entirely surrounded by high ALP areas one would expect the contagion effect to apply particularly here. However, the seat of Q (Maribyrnong) has been held by the current Liberal member since 1955, and it was held on identical boundaries in 1961 when there was a swing away from the Liberals then. The

personality and standing of the candidate would seem to be important, though a detailed analysis of the seat has not been made. The DLP candidate in 1966 had the same surname as the ALP candidate, and was placed above him on the ballot paper; any error votes thus gained would contribute to the voting discrepancy but would not entirely explain it.

In absolute figures the DLP vote of 17.40% in 1961 was reduced to 16.18% in 1966, but with a mean of 15.69 and a standard deviation of 3.07 in 1961 and a mean of 12.51 and a standard deviation of 2.46 in 1966, then there was a relative increase of DLP vote in Maribyrnong from a standard score of 0.56 in 1961 to one of 1.49 in 1966. However, given the history of the seat, the DLP error vote does not fully explain the social and vote discrepancies of Q.

The second isolate of note in Melbourne is J, an area of secondary high socio-economic status with a higher than expectation ALP vote, but which is surrounded by primary and secondary high socio-economic status areas. The ALP candidate was female and was first on the ballot paper, but, J also has a fairly large proportion of the Jewish population and so this could help explain the higher ALP vote there (Taft and Goldlust, 1970).

Other isolates of less importance are H and M, but these can be treated as random variation without much affecting theory or analysis.

In Melbourne Q was given independent status as a single region but J was included as part of its heirarchical grouping region. In Sydney S was connected to X.

7. ALP residual and social distance

The %ALP vote has a high linear correlation with socio-economic status, but the remaining unexplained variance (36% in Melbourne and 19% in Sydney), when expressed as a residual, can be analysed through its correlation with other variables.

The ALP residual, i.e. the %ALP vote with the variance from socio-economic status subtracted, was correlated with the social distance measure in Sydney and Melbourne, and

then the original %ALP vote was multiple correlated with socio-economic status and social distance together:

Correlation	Variables	Syd.	Melb.
Simple	%ALP & SO$	.898	.796
Simple	ALP residual & social dist.	.814	.893
Multiple	%ALP/SO$ & social distance	.983	.939

It can be seen that the residual correlates highly with social distance in both Sydney and Melbourne. In Melbourne the explained r^2 between %ALP and SO$ is increased from 64% to 88% when social distance is included in a multiple correlation, whilst in Sydney the increase is from 81% to 96%.

These variance figures seem incredibly high, but it must be remembered that aggregate data is being used at large areal scales. Even when obtaining the multiple R shrinkage estimate (Nunnally, 1967, p.164) - an unbiased estimate of the population R which takes into account sample size and the number of independent variables - then the Melbourne coefficient is reduced only from .939 to .936, and the Sydney coefficient from .983 to .982.

If the regional social distance measure is used as a measure of regional contagion, then the hypothesis about the form of regional contagion and its power in explaining the remaining ALP variance is clearly supported by these correlations, though of course, because of the nature of the method it cannot be explicitly tested with this data. Further analysis is made below.

8. Geographical and social distance

One would expect social distance to increase monotonically with geographical distance from a regions node.

To correlate the social distance within regions with the geographical distance, two methods are possible. Firstly the absolute value of social difference from the node can be correlated with the geographical distance from the node. When the values for the entire city are used in correlation, they are all positive in sign, and they measure the within-region correspondence of geographical and social distance

for the amalgamation of city regions. In Melbourne this was r =.734, and in Sydney r = .776.

The second method has a different purpose and gives a higher r value. Rather than be descriptive of the correspondence between geographical and social distance, the second measure is used for the analysis of the difference between social and geographical distance, for the entire city, when other variables are involved. For this measure geographical distance is given the same sign as the existing, signed social distance measure. In this case the signs are the same within regions, but different between some regions. This enables both social and geographical distance to be used together in analysis with the ALP residual and other variables. For the second method the size of the correlation between geographical and social distance is not important (in Melbourne r = .866 and in Sydney r = .910), but the differing distribution of the geographic as against the social distance is important.

The second method was used in correlation with other city variables, and from here on the term 'regional geographical distance' refers exclusively to the second, signed measure. Some results are given below:

Correlation	Variables		
Simple	Geo. dist. & social dist.	.910	.866
Simple	Geo. dist. & ALP residual	.839	.709
Simple	Social dist. & ALP resid.	.893	.814
Partial	ALP resid. & soc.dist./geo.dist.	.572	.567
Partial	ALP resid. & geo.dist./soc.dist.	.144	.014

There is a fairly high linear correlation between the geographical distance and both the social distance and the ALP residual; correspondingly the residual is predicted fairly well by either the grographical distance or the social distance. To decide the relative importance of the geographical and the social distance in predicting the residual, each can be alternately partialled from the other two in correlation. In doing this the 'meaning' of geographical is not entirely clear - it could for instance

be a surrogate for other variables with similar distributions, it could measure degrees of physical communication with the nodal areas, or it could be a measure of differing perception of the nodal areas, and so on.

These partials show that geographical distance reduces the variance between the residual and social distance by about a half - so some extraneous effects seem to be operating as well as social distance. However the correlation between the residual and geographical distance is entirely explained by social distance, i.e. the latter 'intervenes' between the former pair.

Thus geographical patterning alone cannot explain the residual, though there is a possibility that something represented by the geographical pattern contributes to the social distance variable to increase its predictive power for the ALP residual.

Whilst it is not clear what this other effect is, it is clear that social distance, as a compound variable, is an efficient predictor of the residual and is more appropriate than geographical distance. It is for the reason of being a compound variable that the social distance measure has been called 'regional contagion'. The term 'contagion' is meant in the most general sense of spatial diffusion, and whilst there is a theoretical implication of spatial social processes, there could alternatively be a gradation for instance, of party organisation strength dependent upon the status gradient.

The postulated lines of influence are given below (with r^2% given for Sydney):

'true' social dist. (30%) →
geographical dist. (50%) → } social dist. as measured (80%) → ALP resid.

9. Regional contagion and life-cycle stage

One of the more patience-trying analyses in non-experimental research is of the multiplicity of inter-correlations between known and unknown variables, a single distribution sometimes being 'explained' by seemingly endless combinations of others. Partialling within a restricted set

clarifies the relationships within that set, but the problem is one of knowing the complete relevant set. This situation exists in trying to explain the residual of the ALP vote.

(a) possibilities

For London, Cox (1968) has developed a model in which 'suburbanism' (life-cycle stage) is used to explain most of the remaining variance of the Conservative vote after socio-economic status has been accounted for. Whilst it has been noted in (1.) above that an age oriented factor is more likely to be of importance in Britain than in Australia, it was also thought that perhaps regional contagion could have better explained the remaining variance in both countries.

In Melbourne, but not in Sydney, there are high negative correlations between distance from the CBD and both the ALP residual and regional contagion. From the differences between the two cities a hypothesis was derived that it is the chance orientation of the ALP residual with distance from the CBD which gives the residual a spurious correlation with life-cycle stage, and that the more meaningful correlation is with regional contagion. If the correlation of life-cycle stage and the residual of the party vote is spurious in Melbourne, then there is a possibility that it may also be so in London - particularly if the residual there correlated with distance from the CBD (which it is very likely to be as distance from the CBD is the variable which loads highest upon 'suburbanism' in Cox's study). Although stage in the life-cycle is a plausible theoretical base for some of the party vote, the measurement of it in some cities may be largely a geographical surrogate for yet another plausible process.

A first comparison of the relative effects of the different variables in the two cities is given by the multiple correlations in table 12a. In Melbourne the simple correlation with %ALP increases with the addition to socio-economic status alternately of life-cycle stage, distance from the CBD, and regional contagion, i.e. within the latter

set of three, regional contagion is the best and life-cycle stage is the worst secondary predictor. In Sydney however, the simple correlation between %ALP and socio-economic status is unchanged by the addition of either life-cycle stage or distance from the CBD, but is increased by the addition of regional contagion. So far the hypothesis is supported, but further analysis is required. Because of the correlations above, then in the next section the relationships for Melbourne alone are examined.

	Correlation	Variables	Melb.	Syd.
(a)	Simple	%ALP & SO$	-.796	.898
	Multiple	%ALP/ SO$ & LCS	.901	.900
	"	%ALP/ SO$ & dCBD	.924	.900
	"	%ALP/ SO$ & CON	.939	.983
(b)	Simple	LCS & CON	.661	.054
	"	LCS & RES	.701	.137
	Partial	LCS & CON/dCBD	-.166	-
	"	LCS & RES/ dCBD	-.025	.077
	"	RES & dCBD/ LCS	-.464	-
(c)	Partial	RES & dCBD/ CON	-.398	-.186
	"	RES & CON/ dCBD	.539	.895
	"	RES & CON/ LCS	.656	.895
	"	RES & LCS/ CON	.373	.198
(d)	Simple	RES & GEOd	.709	
	"	CON & GEOd	.866	
	Partial	RES & dCBD/ GEOd	-.528	
	"	RES & GEOd/ dCBD	.318	
	"	CON & dCBD/ GEOd	-.386	
	"	CON & GEOd/ dCBD	.690	

INDEX:

SO$	=	socio-economic status
LCS	=	life-cycle stage
dCBD	=	distance from the CBD
CON	=	regional contagion
RES	=	ALP residual
GEOd	=	regional geographic distance

Table 12. Relationships between some variables

(b) Melbourne only

The correlation between life-cycle stage and the ALP residual can be entirely explained by distance from the CBD (table 12b), but before assuming that the sociological correlation is zero, it must be remembered that distance from the CBD is a different class of variable, and that it may possibly 'explain' life-cycle stage consistenly. The correlation between distance from the CBD and life-cycle stage appears to be a spatial structure relationship of very basic meaningfulness, i.e. life-cycle stage is concentrically oriented if only because in a city undergoing rapid growth there is no other way that the housing and amenities demands at various stages in the life cycle can be accommodated. The concentric pattern is the most natural random (in the sense of Curry, 1964) spatial organisation to develop - there can be no spacious suburbs with accessible, multibedroomed houses and space for children to play in the inner suburbs because of either the competition for land and buildings there or because of the decay in some parts. Thus the concentric spatial structure of life-cycle stage is forced upon it as a geographical function of other economic and historical functions.

Thus while distance from the CBD is likely always to account for the variance of life-cycle stage (or population density) in correlation, the same is not true for regional geographic distance and regional contagion. Within the party voting regions, there does not seem to be the same very basic processes which give rise the concentric geographic functions for the entire city, and so the regional geographic distance measure is not a measure with the same strength of basic and inevitable spatial organisation within the total city system.

The 'meaning' of distance from the CBD is even more uncertain when used in partialling than is that of regional geographic distance, because it is the geographical basic for so many other distributions. It does correlate $r = .740$ with regional geographical distance however, and so to check whether one is a surrogate of the other, each can be alternately partialled from correlations with either the

residual or regional contagion (table 12d). The results are equivocal as each reduces the simple correlation of the other. Whether or not distance from the CBD has any meaningful correlation within the analysis remains uncertain.

When the correlation between the ALP residual and both life-cycle stage and regional contagion is examined by partialling the latter two alternately, then the variance of the residual is seen to be more explained by regional contagion than by life-cycle stage. To be precise, 35% of the variance of the correlation between the residual and regional contagion was explained by life-cycle stage, whilst 72% of that between the residual and life-cycle stage was explained by regional contagion.[3]

There is a simple correlation of r = .701 between the residual and life-cycle stage, and a simple correlation of r =.814 between the residual and regional contagion; when both are used multiple correlation to predict the residual, then the coefficient increases from .814 to only .842. Thus regional contagion is the better single predictor, the addition of life-cycle stage adding very little.

From these figures it seems likely that there is a small correlation between life-cycle stage and the residual, but that this overlaps into the regional contagion measure, i.e. a third of the relation between regional contagion and the residual could be due to life-cycle stage. Contained within the regional contagion measure, life-cycle stage contributes to its predictive abilities, but does not add much when added separately.

These figures were obtained for Melbourne but not for Sydney, and this raises the possibility that the observed overlap between life-cycle stage and regional contagion is a product of the deductive method. The outer eastern divisions (C, F, P) are included with the inner eastern divisions according to the axes plot, but the random error in this grouping cannot be assessed. There is also another

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3. The percentage variance reduction is given by:

$$\{1 - (r^2_{12.3} / r^2_{12})\} \quad x\ 100$$

possibility that migration from the inner eastern suburbs accounts for their higher non-ALP vote rather than some other sociological form of regional contagion. The doubts about the method emphasise its hypothesis generating nature, and the hypotheses generated are discussed in section 14 below.

A final consideration is that when distance from the CBD is substituted for life-cycle stage in the partialling of the residual and contagion (table 12c), then whilst the correlation between the residual and distance from the CBD is reduced by 74% (approximately the same as for life-cycle stage), the correlation between the residual and regional contagion is reduced by 54%. The possible causal contribution of distance from the CBD to regional contagion could be in the form of the different social bases to mobility interacting with life-cycle stage, i.e. the eastern suburbs movement, as mentioned, is probably over a greater distance when compared to any outward oriented life-cycle stage movement confined to the western half of the city. The western suburbs contain greater concentrations of industry, and a lower economic status population with a lower degree of social and geographical mobility, manifested not only in day to day contact but in house-moving too (Webber, 1964). A second possible interpretation of distance from the CBD is similar to that of regional geographical distance - a perception surrogate involving self and location, but again confined largely to the eastern half of the city.

In summary,

(i) the multiple prediction of %ALP favours regional contagion as the second explanatory variable in both cities. The differences between the two cities particularly emphasise this, neither distance from the CBD nor life-cycle stage adding to socio-economic status in prediction in Sydney.

(ii) In Melbourne there appears to be some structural relation between life-cycle stage and regional contagion, with the former probably contributing in a small way to the variance of the latter. This could also be chance variation

maximised by the deductive method; because a number of interpretations are possible the probable reason for the overlap in Melbourne remains unclear.

(iii) The differences between the two cities have implications for studies elsewhere. Whilst regional contagion appears to be the best second predictor variable for both Sydney and Melbourne, the possible contribution of life-cycle stage to regional contagion in Melbourne might have its counterpart in a more extreme form elsewhere. The relationship between the concentric patterns and the more sectoral or nucleated socio-economic status patterns could be important here. In particular life-cycle stage should have more importance where there are fewer elections and where voting is not compulsory.

10. One election

Because the results are for one election only, there is a chance that they include the 'error' influence of issues peculiar to that election. Although the boundaries for the 1961 election were identical to those for the 1966 election, a full comparison cannot be made because some of the census data available for 1966 was not available for 1961, and an equivalent socio-economic status measure for 1961 could not be constructed.

It is possible to get the change in %ALP vote between elections, independent of the 1961 percentage, by using the regression transformation. The figures for both elections are correlated, and a residual is obtained which gives the change independent of the 1961 figures (Ferguson, 1966). This between-elections change is an indication firstly of swinging seats, and secondly of election-specific variation.

When the between-elections change is partialled from the correlation between the ALP residual and regional contagion for both Melbourne and Sydney, the correlation remains all but unchanged. In Sydney the correlation changes from $r = .893$ to $r = .882$, and in Melbourne from $r = .814$ to $r = .820$. Using this index of election specificity, the postulated regional contagion effect was unaffected by the differences in %ALP between 1961 and 1966.

11. Pattern analysis

Given a cross-section through a number of regions in the city, then the profile of the socio-economic status surface can be plotted, and the ALP residual can be plotted as a deviation from the socio-economic status surface. The form that the two profiles should theoretically take is given in figure 15a. With distance from the high status node, then the ALP vote decreases beyond the expectation based upon socio-economic status, and with distance from the low status node, then the ALP vote increases beyond the expectation. The continuity of the residual deviance is shown in figure 15a, and it is clear that both the step in the residual surface, and more specifically the point where it crosses the status surface, can both be used as regional delimiters.

When two sample profiles are plotted for the two cities, however, two types of relationship are observed between the socio-economic status surface and the ALP residual (figures 15b and 15c). These are:

(a) Type A - the theoretical, hypothesised trend - regional social influence is in the form of an increase of the ALP deviation with distance from the low status node (and vice versa for the high status node).

(b) Type B - a trend in the opposite direction, with a decrease of the ALP deviation with distance from the low status node (and vice versa for the high status node).

In figures 15b and 15c, type A can be seen between Z and F or G, and between E and N or R for Sydney, and between N and D or C, and between T and V or U for Melbourne. Type B can be seen between YT and R, and between M and D, and between X and G for Sydney, and between N and V for Melbourne.

The two types of relationship correspond to the two types of opposing slope in the plot of the ALP residual against socio-economic status (figures 13a and 13b), and do in fact represent within and between region trends as

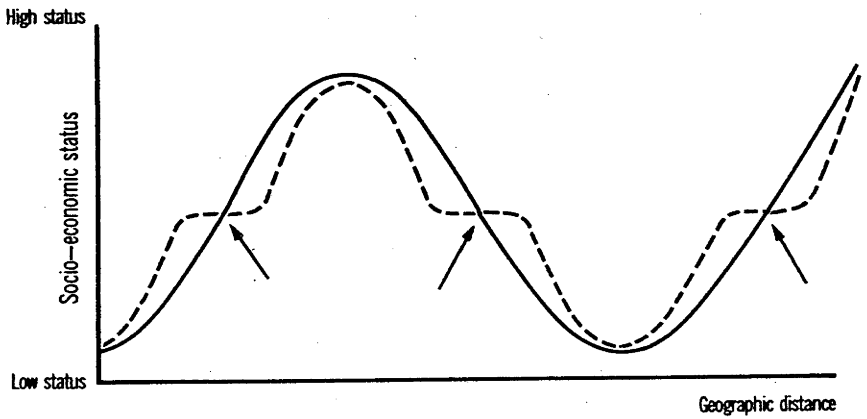

Fig. 15a. Theoretical relationships between socio–economic status and the ALP residual

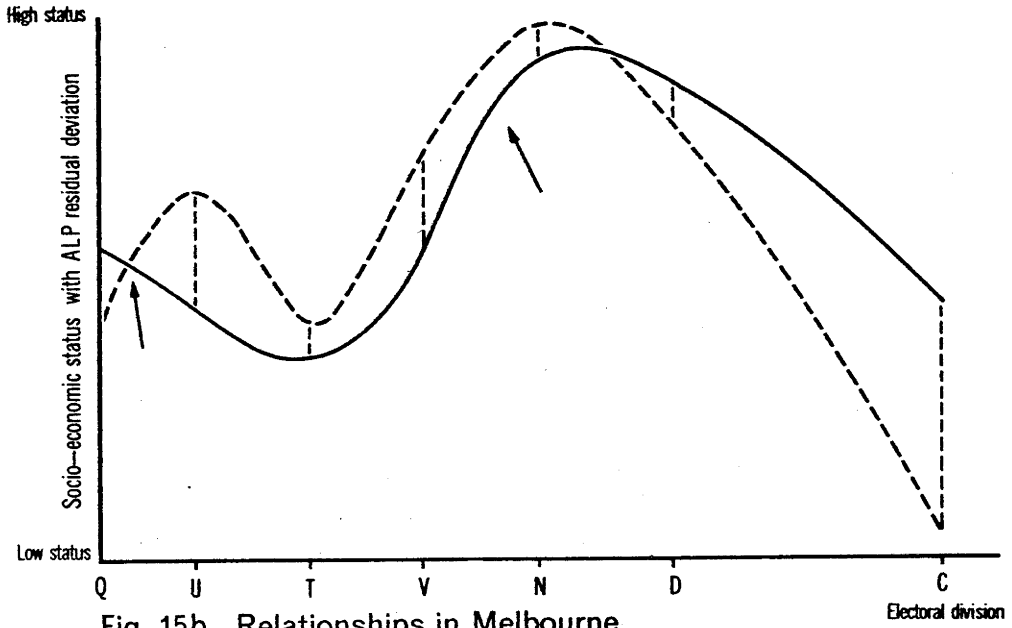

Fig. 15b. Relationships in Melbourne

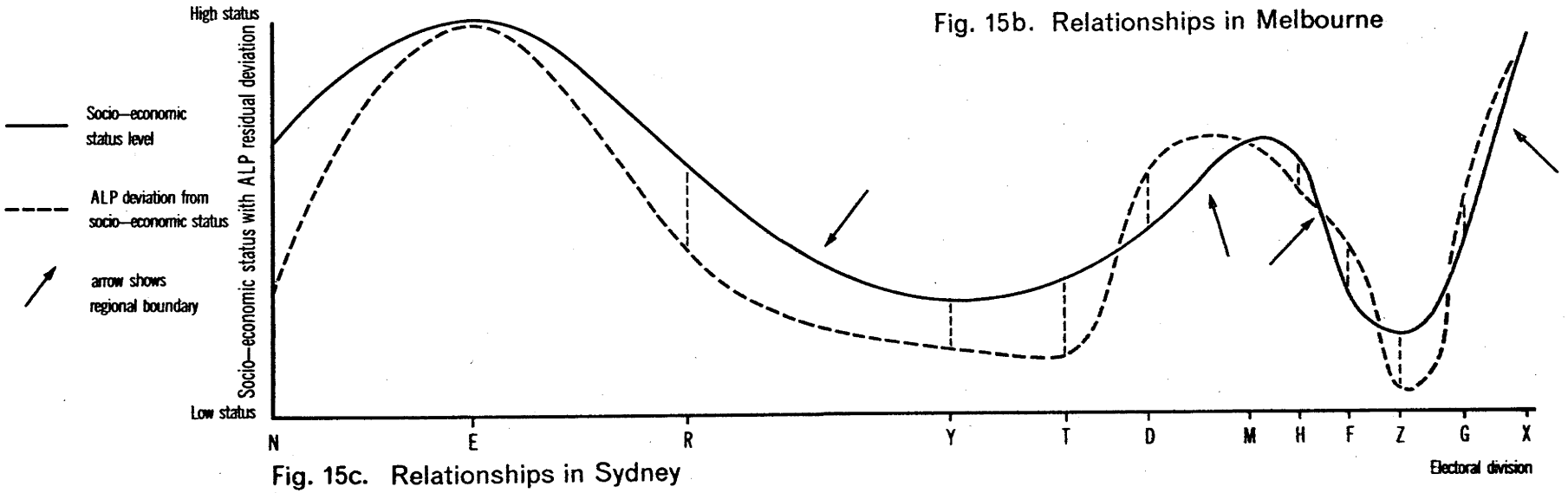

Fig. 15c. Relationships in Sydney

illustrated by the axes plot. The plot illustrates that the type B relation can have two forms, the first being the distance relation as described above, and the second being a pair relation between adjacent electoral divisions from different regions. The latter is assumed to be a non-active process. Type A is the deduced (active) within-region relationship, whilst type B is either a second (active) process, or is the remaining between-region (non-active) relationship.

It is obvious that the derived within region relationship is a logical result of using %ALP similarity as the regional grouping criterion, as the type A relation tends to even-out the similarity of %ALP within a region whilst the type B relation tends to increase the differences.

Thus for this study one must ask: what is the theoretical alternative to grouping by similarity? We cannot group by process, for process is unknown, and it is process which is being inferred from the similarity grouping of the static patterns.

In fact it is implicitly assumed by choosing a similarity grouping that the type A relations represent an active process, whilst the type B relations represent either an inadequacy of method (see below) or a non-active transition zone between regions. As an explicit part of the method, it has been previously stated that the theoretical function of the similarity grouping (using %ALP) is to select out and maximise the measurement of type A relations.

If it were also possible to obtain a regional dissimilarity grouping (the criteria being (i) contiguity, (ii) the most dissimilar contiguous value) then regions would be derived which would have maximum internal heterogeneity, with minimum variance between regions. Given nodes and appropriate heirarchical levels, then distance from the node measurement could be made; this method would presumably select out and maximise the measurement of type B relations.

There is a drawback in that dissimilarity grouping is very subject to chaining, and for both Sydney and Melbourne (using %ALP) single electoral divisions were progressively added to the initial pair for the entire heirarchy. Therefore a number of discrete regions could not be formed by this method.

Alternately, one could group subjectively, using existing nodes, and using the axes plots and maps as guides, with the aim being to maximise the measurement of type B relations. Some interesting patterns emerge when using this subjective method:

(i) conceivable type B relations for Sydney:

YT to O, R
M to D, L, A, B
X to G, K

Six electoral divisions are taken up as nodes (altogether, figure 14a), and of the remaining twenty, eight could conceivably be taken up as having type B relations with the node.

(ii) conceivable type B relations for Melbourne:

N to B, V, (M, J)
T to Q
OE to F

Three electoral divisions are taken up as nodes (figure 14b, but Q is not a node here), and of the remaining nineteen, six could conceivably have type B relations with the node.

Firstly, it is evident that for the region of very high, and for the region of very low socio-economic status for both cities, very few type B relations are possible. In other words the major status regions are most appropriately represented by type A relationships.

Secondly, some of the remaining type A relationships in secondary status regions are unaltered, whilst the type B relations always cross the boundary where the node is adjacent to it (with the exception of N to M and J in Melbourne). Taken together, it is apparent that there is

an element of directionality involved in determining the type of relation for the non-major socio-economic status regions.

The feasibility of some of the directions are analysed:

(a) for Melbourne:

(i) The link from N to B crosses the Yarra where there is likely to be little neighbourhood diffusion due to the clear break in residential continuity. The link from N to V is partially subject to a similar effect.

(ii) The link OE to F is partly split by the Yarra, but the heterogeneity of the peripheral unit makes analysis difficult.

(iii) T is separated from Q by V and R and therefore has no direct link.

Consequently B and Q could be excluded from the type B relations for Melbourne, leaving four remaining.

(b) for Sydney:

(i) The link YT to R is partially split by the Parramatta River.

(ii) The node M is a weak one in a small region, whilst B is separated mainly by Q and U; therefore B is less likely to be influenced by M.

(iii) For the relations X to G and K, there is a great socio-economic status difference to G, but with only a slight difference in the ALP residual (axes plots); the type B relations with K are better by axes plot but K is geographically mediated by G and S and so the relations are unlikely.

Consequently there is a possibility of excluding R, B, G, K from the type B relations for Sydney, leaving four remaining.

The possible frequency of type B relations has been reduced; interpretations of the remaining possibilities follow.

Three interpretations of the type B relations are possible:

(i) that they are an artifact of measurement error, the large discrete units inadequately representing continuous series. If a nodal electoral division is adjacent to a boundary, there is a possibility that both the continuous series node and the type A relations could be contained within the one electoral division. The latter relations would be operating over quite a short distance and joining with those of the next region in the hypothesised crossing of residual and socio-economic status surfaces. These relations could exist but be masked by the large units. Analysis of relations near to boundaries is very inadequate because of the electoral division sizes; there is a possibility therefore that type B relations are a function of electoral division size.

(ii) that they are a sociological reality, the two types of relations being present in the one city, though with type B being less prominent. In secondary regions, if type B relations are a reality, then their direction from the node is important.

(iii) that the patterns in secondary socio-economic status regions are random. All contagion relations assume that the node is an independent source of influence, and whilst this may be so for the extremely high and low status nodes, the level of detail allowed by the electoral units does not allow analysis of the smaller and 'weaker' status regions to be made with great confidence. Hence the degree and direction of influence is perhaps too open to selectivity for these secondary regions. The selectivity probably does not influence the correlation coefficients greatly, as most of the variance of the regional contagion measure is taken up by the very high and low status regions.

In summary, then on the basis of the evidence considered, type A relations seem more likely than type B relations to account for a contagion effect upon the ALP vote. Firstly they only are present in the major status regions, secondly type B relations can be fitted only for a few electoral

divisions, thirdly the type A nodes are in the centre of the major regions (the Yarra limiting N, and Merri Creek perhaps limiting T, to B, in Melbourne), finally the type A patterns on the bivariate plots are more prominent. The type A relations appear to be more regionally coherent, i.e. the relations between geographical distance, social distance, and the ALP residual are generally monotonic from the central node. Whilst there may be some doubt about secondary region patterns, type A relations are the most appropriate ones for the major status regions.

12. Within-division variability

Before considering the theoretical implications of the regional contagion measure, the previously mentioned measure of within-division variability (chapter 4, section 7) is examined in relation to regional contagion. Valkonen (1969) relates ecological variance to ecological process (implicitly, as the analysis is of static relationships), and as regional contagion is hypothesised to be a directional form of ecological process - a regional diffusion type - then the implications of differing regional variance are worth considering.

a) methodological check

There is a possibility that the correlation between the ALP residual and the regional contagion measure could be partly due to some systematic regional within-unit ALP variability. Consequently the ALP variability measure was partialled from this correlation for both Sydney and Melbourne, but neither correlation changed beyond a few percent of variance. The measure of within-division ALP variability therefore did not account for the relationship.

b) sociological significance of the ALP variance

The difference between the individual, simple ecological, and regional contagion effects has been explained in chapter 1. If there is a regional contagion effect, then it is evident that there is both a simple and a regional ecological effect as well as individual influence upon the relationships between socio-economic status and %ALP.

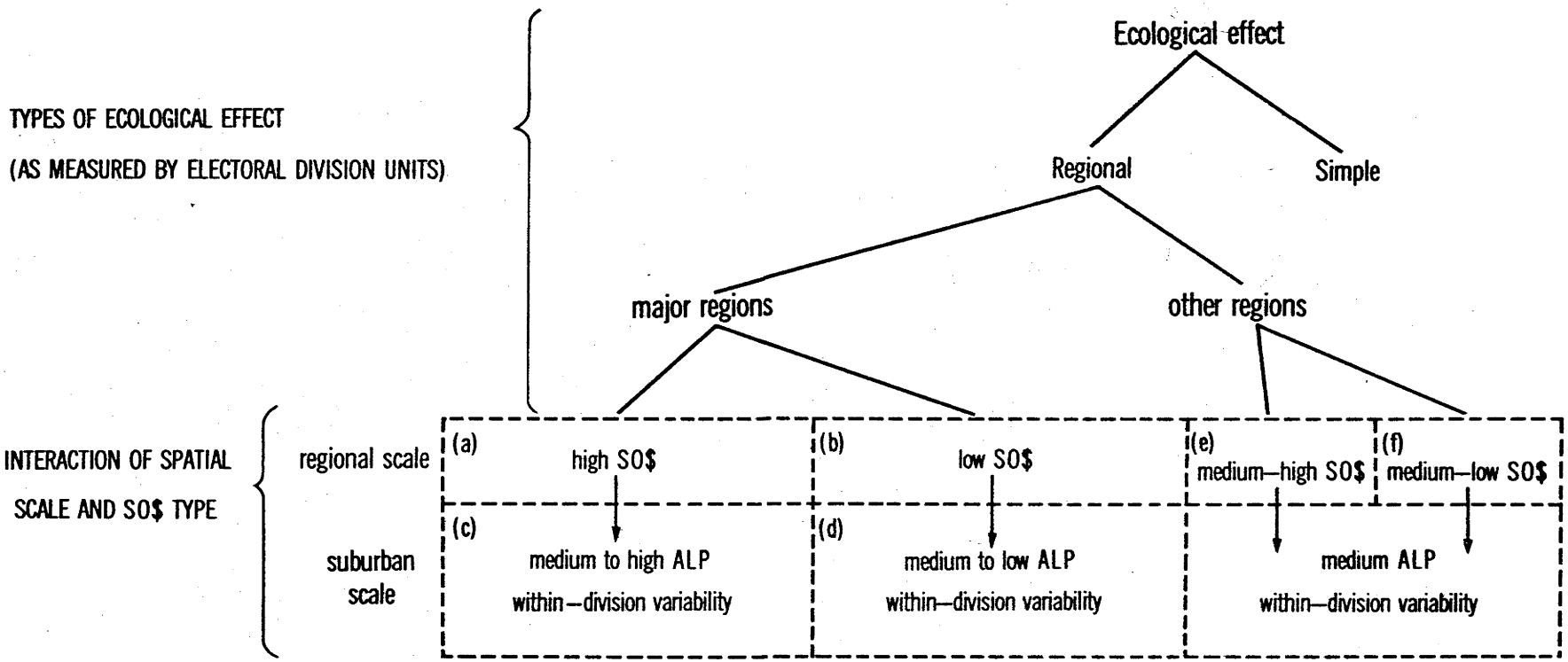

Figure 16. Classification of ecological effects, with SO$ type and scale

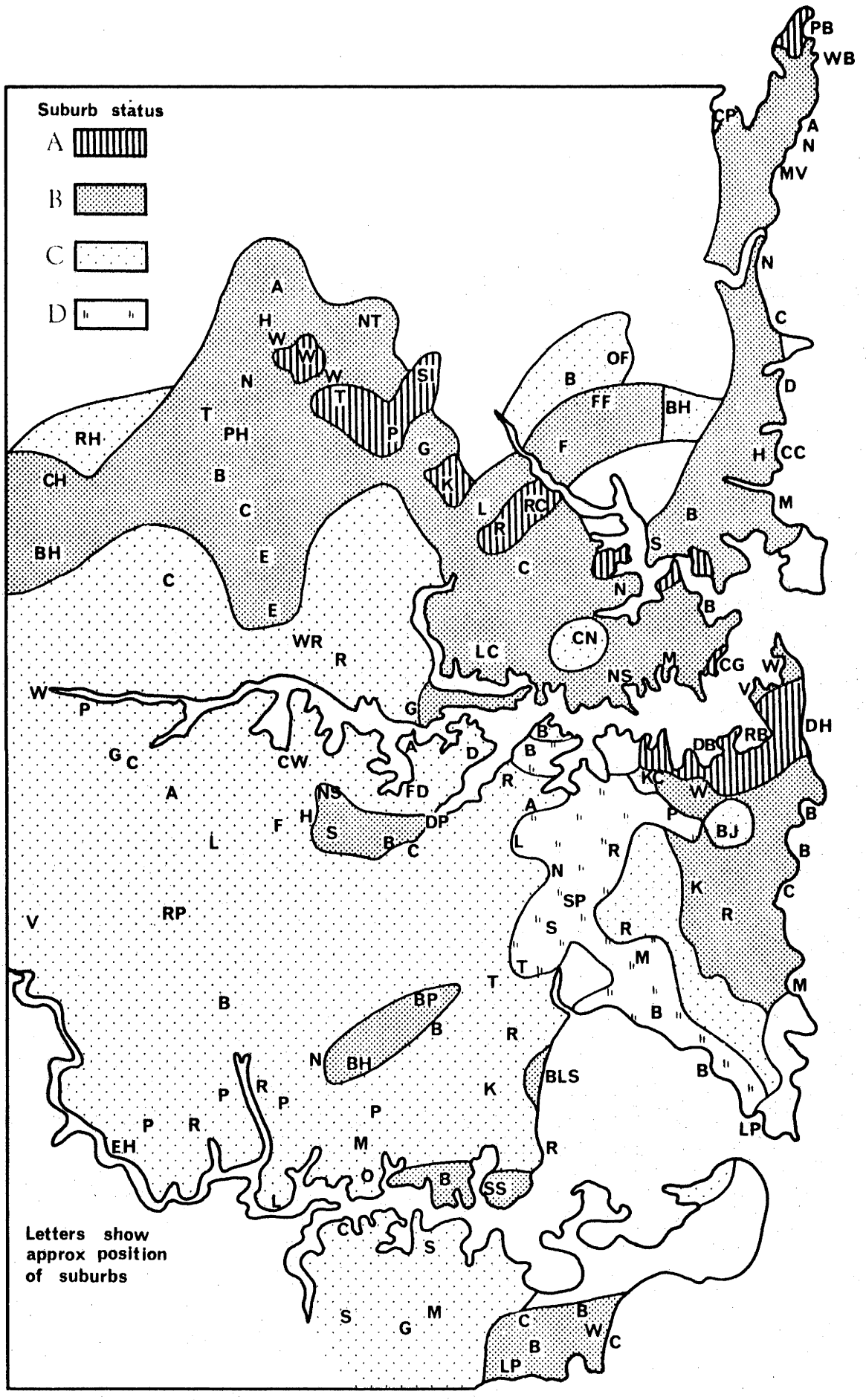

Figure 17 Congalton's map of social status

Any measured ecological effect varies with the size and 'fit' of the areal unit (Valkonen, 1969; Duncan et al, 1961). Given a continuous three-dimensional surface of either the dependent or the independent variable, then some methods (such as those used for regional contagion) are needed to analyse the geographical limitations and forms of the ecological influence.

Figure 16 shows a classification of the types of ecological effect along with socio-economic status and within-division variability. In each city the two major contagion regions correspond to regions of high and low status (cells a and b, fig.16), but at a finer areal scale there is a differentiation between the major high and low status regions by ALP within-division variability in each city (cells c and d). The latter represents a difference in the areal variability of party voting behaviour by socio-political regions.

Given regional behavioural differences, in terms of within-division variability, one needs to know if this is a difference in ecological response to similar residential social status, or if it directly reflects differing social status variability.

Congalton's (1961) map of the perceived status of Sydney suburbs is firstly one of human perception, and secondly is based upon smaller areal units, i.e. the perception units of 'suburbs'. His sample was of 56 real estate agents and 87 other people, and they were asked to rank suburbs in terms of high to low social standing on a seven-point scale. The seven-point scale was reduced to four categories and these were mapped (figure 17). He reports considerable similarity between this scale and other non-perceptual scales of social status, and, especially because of the inclusion of real estate agents, one would expect quite a similarity between the scale and a status factor derived from a factor analysis using smaller areas. There will logically be some variability in the scale which is a function of perception however, and this gives the appropriate perceptual base to status from which some behavioural actions would derive their meaning. Nevertheless,

it will be accepted as broadly reflecting a non-perceptual measure of socio-economic status.

The map shows the northern region of Sydney to be quite differentiated, in contrast to the uniform western suburbs; the eastern and central areas are fairly variable. It suggests that perceived status (morphologically) explains the regional within-division variability of the ALP vote.

A second explanation is that there was a real difference in behaviour - suggesting a greater 'solidarity of the lower-middle class' perhaps, against the more individualistic and inequality oriented ethos of the non-ALP voter. This of course could be reflected in the residential basis of ones life-style as well as in behavioural action such as voting (it is possible to have ideals of individualism, which are strongly conformed to, or which exist side by side with other conformity!). This further suggests an interaction between the two, which taken with a local conformity (or contagion) in behaviour, would give the greater regional response to status variability in high status regions.

There is evidence that territorial social relations vary in type and extent with socio-economic status (Webber, 1964), the lower status social and information exchanges being much more locally oriented. The lower status individuals are less socially and geographically mobile, and there is probably less regional variation of values, attitudes, and life styles (this appears to be so at a fine scale, cell d, Fig.16; at the regional scale, cell b, the pattern is less clear). The greater mobility and aspiration for socio-economic success of higher status people could make them more sensitive to the values and behaviours of the status levels above them, hence one would expect the greater regional contagion effect in high status areas (cell a, Figure 16) (the distribution here is dichotomised into 'high and low'). The regional contagion effect in low status areas (cell b, Figure 16) appears to be less clear (it is less linear in Melbourne), and it could simply be that the social aspirations of upward mobility are much

less in effect there. Aspirations of this kind would tend to emphasise a regional contagion trend in higher status areas, and suppress it in lower status areas.

Unfortunately, given the present data and time limits, the possible reasons for the different variability surfaces cannot be analysed quantitatively. However the theoretical approach of Valkonen (1969) does suggest that there is a real ecological-behavioural difference between the two high and low status sub-populations. Valkonen derived from Blalock (1961) and from Duncan et al (1961) that "the difference between the ecological correlation and the individual correlation is a function of the sizes of the areas and the ecological variance of the independent variable" (p.61).

This implies that some form of ecological effect exists in the high status regions which is greater at finer scales, when compared to low status regions, because:

(i) if the ecological variance of socio-economic status was the same for both high and low status regions, then the observed difference in the variation of the ALP vote would be indicative of either a regional contagion type of ecological effect at a finer scale, or of the influence of another variable effective at that scale. It is difficult to envisage what type of other variable would be connected to ALP voting only at the subdivision scale (approximately equal to 'suburbs'), unless it were ecologically related to socio-economic status,

(ii) if the ecological variance of socio-economic status is different in the high and low region, then the difference between the individual and the ecological correlation would be different in the two regions, there being a greater ecological effect in the high status region.

Congalton's map gives some empirical basis to the latter possibility by showing that the higher status regions contain greater prestige differences - in the form of gradients separating the fewer very high status suburbs from the more lower status suburbs.

Whichever possibility is appropriate, it is likely theoretically that high and low status regions form two different behavioural subpopulations for the whole city. If this is the case then not only is there a 'non-linear' ecological pattern development from social characteristics to party voting behaviour, but there is a different kind of behavioural result for the two subpopulations. Given social and psychological theory and observations about social class differences in behaviour, this is not unexpected. What the regional contagion and variability analyses do suggest is the nature of the geographical relations when expresses as ecological effects, between party voting behaviour and social characteristics within the regional structure of the city.

13. Summary of method and results

(a) method

The method is logically deductive, not predictive nor hypothesis testing. Hypotheses are generated about the structure of a geographically oriented behavioural component to party voting, and these can be examined informally (qualitatively) by assessing the value of the strength of the deduced statistical relationships, and by discussing the theoretical value of the hypotheses.

Where

Y = %ALP vote
X = socio-economic status
W = regional contagion
E = error

then the method assumes that Y is caused by X and W, and therefore that Y contains the influence of both X and W, plus E.

It then uses the inductive method of regional grouping to define regions by Y, i.e. regions grouped by both X and W, plus E. Both Y and X have been defined and located in space, but W has not been. The method deduces the location of the combined patterns of X and W, in as far as their importance for Y, by assuming no other systematic effect

accounts for Y. Only random error is assumed to affect the pattern.

Blalock (1961) warns against grouping by Y, here %ALP, but this method has been used specifically to include and identify the location of the second predictive variable. In doing this error is also maximised; hence the method's non-inferential nature.

Only the postulated regional limits of X and W are formally deduced, not the substantive measure of W, though the magnitude of this will for some electoral divisions depend upon the boundary placements. The regional boundaries specify the geographical limitations of W, and the question of which level in the heirarchy of regions to use is answered again deductively by using the bivariate plot of the ALP residual upon socio-economic status. This defines which electoral divisions fall within sub-sample linear trends, and these subgroups from the plot can be matched with the membership of the regional groups at different heirarchical levels.

The regional node is taken to be the highest or lowest value of X in the region depending upon whether the regional values are above or below the mean, and W is taken to be the value of the difference of X between each electoral division and the node.

Because the node is either a high or low value of X, then the values of W will have different signs according to whether the region is of high or low socio-economic status. Thus the significance of the boundary placement is evident: if an electoral division between adjoining high and low X regions is included in one, it would probably have a high positive value of W, and if included in the other would have a high negative value of W. The difference between grouping by X and grouping by Y is in the placement of the regional boundaries and therefore in the sign and size of W for some of the peripheral electoral divisions located 'between' regions. The grouping by Y assumes that the influence of W can extend beyond the regional limits defined by X.

The meaningfulness of the placing of the boundary is understood in terms of the arbitrary break-up of a continuous space series. There is probably a continuous gradient of socio-economic status and %ALP vote in most parts of the city, but electoral divisions break up the continuity by being discrete units for which averages are obtained. There is probably a continuous and perhaps overlapping fall off in W influence from each node, and so theoretically a line of equality of influence between two nodes could be drawn. Because discrete units are used, the boundary which runs between and therefore defines two units must be used as the edge of a region. Thus the within-unit average must be used to define whether it is predominantly oriented to one node or the other in terms of W. Because of the size of the units, analysis of relations is very inadequate in secondary status regions, and where nodes are adjacent to boundaries.

The method can only generate the hypothesis that the pattern of W is as deduced. To test the hypothesis, one would need to be able to causally identify W, then to define its pattern, and then to correlate W, defined with new data, with the ALP residual. This is clearly beyond the scope of this study, though this study can suggest theoretically what W might be.

In partial correlation analysis, regional contagion (W) is not independent of the ALP vote (Y), whereas a factor such as life-cycle stage is. This means that any relations derived are descriptive and suggestive rather than being inferential or predictive. Again, hypotheses about the structure of the contagion component are being generated.

For example, in subtracting the variance of life-cycle stage from both the residual and regional contagion, the remainder could be related because of the dependency element. In subtracting the variance of regional contagion from both the residual and life- cycle stage, the dependency element is subtracted from the residual. Thus on these grounds alone one would expect a larger remaining correlation coefficient in the first case, and this was the result actually obtained (section 9 above, for Melbourne).

The interpretation of these results involves as full an awareness as possible of the potential errors in the method, an evaluation of the worth of the magnitudes of relations, the consideration of the variety of causal explanations in terms of theory, and the comparisons between cities.

(b) results

For both cities there appear to be two additive and approximately linear relations which explain the geographical variance of the ALP vote. The first is the simple distribution of socio-economic status, and the second is a regional component of the socio-economic status pattern. These form a first approximation for the explanation of party vote variance.

There is probably some interaction of the regional component with life-cycle stage, particularly in cities where there is comparatively less political immunization.

Within the limits of method, the regional contagion measure is appropriate for the major status regions in the two cities, though doubt remains as to the validity of the measure for minor regions and for a few electoral divisions.

There are likely to be behavioural differences between the major high and major low status regions, partly reflecting different degrees of variation of socio-economic status and partly being a different behavioural response to their social areas.

14. Theoretical causes of regional contagion

a) Selectivity of life-cycle stage

In section 9 above, some overlap between the measures of life-cycle stage and regional contagion was considered, and it was thought that this might vary with city and electoral system. Some possible reasons for any overlap are as follows:

(i) Assume that there are more younger electors where there are extreme regional contagion values, i.e. towards the periphery of regions. According to the immunization

theory they will be more flexible, and more receptive to their social milieu than older electors. Thus there would be a greater contagion of a regions political values where there are more younger electors. Typically there would then be more single young electors in the inner city, and more married young electors towards the city's periphery.

(ii) Assume that most young electors have moved into their locality rather than having been born in it. It would be interesting to trace their movements, and particularly to find in what kind of status region they grew up in. One explanation for an overlap of life-cycle stage with regional contagion is that young electors might migrate from origins within a particular status sector, but move to inner or outer city locations within the same (or a similar) sector. That is, life-cycle stage movement is generally confined within social status sectors.

In this case the 'regional contagion' influence would be partly due to the origins of the young electors, and to their 'original' political values being consistent with their status region (Butler and Stokes, 1969, ch.3). If this were so then young electors moving from low socio-economic origins would probably achieve a higher socio-economic level than that of their origins, due for instance to the general upwards trend in working class incomes and the increased earning power of youth (Butler and Stokes, 1969, ch.5). On the other hand young electors moving from high socio-economic origins would initially be placed at a lower socio-economic level than their origins because of the general trend to 'start at the bottom of the ladder' for very high salaried professions (or positions), and to gradually obtain a higher income over their lifetime, and eventually become located in the higher status areas.

Thus if there is selective migration by young electors, then the regional contagion effect could be explained by either regional contagion influence or by the influence of their origins, or by both.

Butler and Stokes (1969, p.51-52) give evidence that although the carrying on of the family tradition is generally strong in Britain, more children and young voters

vote according to their socio-political milieu if it is different to their parents' beliefs. Levin (quoted in Segal and Meyer, 1969, p.231) also found this with high school students in the U.S.A. Thus general regional social contagion effects can be operating together with the combined effects of selective migration.

b) Party organisation differences

For the gradient from the node to be a function of party organisation differences, there is an implication that party organisation is a function of regional socio-economic status. However the strength and influence of the party organisation would have to increase above and beyond the economic status level as one moves from the node to the periphery of a region. There are no observations to this effect to my knowledge. In fact the few studies which have been made on this aspect, methodologically weak as they may be, point to a different type of influence:

(i) In the U.S.A. the Republican Party, in Britain the Conservative Party, and in Australia the Liberal Party all have a greater number of party workers, generally, and at election time (Segal and Meyer, 1969; Berelson et al, 1954, ch 10; Butler and Stokes, 1969, ch 19; it has been observed but not documented in Australia[4]). This gives a high/low social status dichotomy, but no other regional pattern. One would expect on the basis of this dichotomy that if there was a party organisation effect then it would be greater in non-ALP areas. Therefore one would expect the regional contagion effect to be different in high and low status regions (unless the effect in (ii) below holds). This could be so in Melbourne but is not so in Sydney (see figures 13a and 13b). If there is a party worker effect, then it is at the within-division scale rather than at the regional scale.

(ii) The study by Putnam (1966) showed if anything that both parties concentrated on the same areas almost equally.

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[4] Personal communication - Dr. F.B.Smith, History; Dr. D.W. Rawson, Political Science; Mr. M. Mackerras, Political Science; all of I.A.S., A.N.U.

Whether this is so in Australia is unknown, though it seems to be unlikely[4]. The methodological weaknesses in Putnam's study are that people are asked to recall which party workers contacted them, and as Butler and Stokes (1969, p.422) indicate, this is probably inadequate. He also does not account for the effect of the predisposition to listen to what one wants to hear, nor for the selectivity by party workers of areas or people generally known to be sympathetic to their party. Finally there is no real knowledge of the nature of the 'influence' of the party organisation.

(iii) Butler and Stokes (1969, p.422) state that "canvassing is aimed at activation, not conversion", and if this is so then it must logically be more successful where voting is not compulsory. They make evident that for the major parties in Britain, then some slight effect by canvassing is a possibility. However, if the effect is very slight in a country where voting is not compulsory, one would not expect the extra 15% to 20% of the ALP vote (that 'explained' by regional contagion) to be caused by party organisation and canvassing in Australia, where voting is compulsory.

c) Social contagion

The original hypothesis was that the 'regional contagion' effect is a form of spatial social contagion. Reviews of studies and some possible types of social contagion follow.

(i) methodology critique

Many studies hoping to establish causal relations between environmental and individual variables are weak in technique. Many use cross-tabulation, which as Tannenbaum and Bachman (1964) have shown can produce spurious environmental effects. This is a pity as much of the argument for or against certain causal social processes is based upon uncertain studies. Segal and Meyer (1969) use cross-tabulation in their study of political partisanship but they claim to have controlled for the spurious effect. The studies by Putnam (1966) and Cox (1969) have more serious weaknesses, which again is unfortunate as they have

attempted to analyse the social process of political influence within types of regions. The weaknesses of their studies are firstly that they both group areas by the dependent variable (party vote), and secondly that there is neither clear control for selectivity into some groups nor an explicit explanation of the alternative processes possible because of the selectivity. These weaknesses are discussed because any theorising about process must take into account the methodological inadequacy of existing studies.

As Blalock (1961, ch 4) has detailed, grouping by Y (the dependent variable) not only groups X (say a major independent variable) but also maximises the grouping of insignificant variables U, V, W, in relation to Y. Whilst the latter maximisation can be used provided that there is a clear understanding of the process involved, it cannot logically be used to establish a causal process between U, V, W, and Y. As Blalock shows, high and causally spurious correlations can be obtained between 'really' insignificant variables U, V, W, and Y, when there is a grouping of units by Y.

The studies by Putnam (1966) and Cox (1969) group by Y and then further subdivide each Y group according to the variable to be studied, say U. The relative differentiation of U within each Y category is then examined. The weakness of this method is that, because of the grouping by Y, U could be really an insignificant variable, and the differences being examined may simply be insignificant differences which have been maximised in relation to Y. That is, the variable may not be really important in causal terms and so causal inferences are confounded. The relations obtained by Putnam (1966) and Cox (1969) are weak in magnitude, and so their results are made even more doubtful.

Their methods fall logically into the hypothesis generating rather than the hypothesis testing category. They can say when a variable has no effect in a relation, but they cannot really say when it has an effect. They use the

method to test hypotheses about the influence of U, V, W, upon Y, and each gives conclusions. These conclusions must be suspect because of the weaknesses of their method.

The second form of weakness in their methods, and the conclusions of Segal and Meyer (1969) are included in this criticism, is that there is little allowance made for natural group selectivity. Tannenbaum and Bachman (1964) draw attention to the fact that there is usually some natural selection both into and out of groups, and that this selection can produce spurious group (or ecological) effects. Cox (1969) is aware of the problem of discerning between group information flow leading to conversion, and 'homopolitical selectivity' - the tendency of like to seek like in social and political, formal or informal interaction. This selectivity is probably not only restricted to social and political groups, but also to time and place, and to actual discussion also. That is, people will seek their most comfortable and happy ecological niche according to their personalities, background, desires etc. This involves not only a search for the appropriate residence - say a combination of socio-economic status and life-cycle stage - but involves time related activity in migrations and settlement such as frequencies of movement and length of time of stay. The amount of time spent in a place is a function of personal and life-history characteristics and is another form of selectivity. Then again, informal discussion is often a function of selectivity, as any social psychologist can attest. Learning theory produces a simple feed-back model in which general agreement in discussion is a form of reward, whilst general disagreement is 'disagreeable' to those involved. Thus those who discuss politics frequently would be selected according to firstly their interest in politics, and secondly their general agreement, within some limits, about politics.

There is a wide range of selectivity involving the variables used in existing studies. Cox (1969) is aware of the problem for social groupings, but does not really control for it. Firstly he merely argues for influence rather than for selectivity, without evidence or without

considering explanations by selectivity. Secondly, he attempts to control for one type of selectivity by introducing another type, without recognising the selectivity of the second type (e.g. using length of time in residence, and political discussion, as controls for social selectivity).

Evidence for some types of selectivity is at hand; the ability of parties associated with high social status to attract workers is mentioned in section b above. Segal and Meyer (1969) also note that people participating in voluntary organisations in general in the U.S.A. are more likely to be Republican regardless of their own or their neighbourhood's socio-economic status. This is significant when membership in these organisations is used to analyse political information flows in relation to the neighbourhood. Segal and Meyer (1969) found that there was this selectivity by party affiliation with respect to voluntary organisations, but claim that there was also an ecological effect, i.e. that local neighbourhood influence decreased as membership in organisations increased. The latter could, because their dependent variable was the percentage Republican vote, have been a function of Republican Party membership in organisations in non-Republican areas, and the lack of difference in ecological effect between high and low status neighbourhoods could be due directly to this, in spite of their claim to the contrary.

The problem has been put as selectivity versus influence, but there can be interactions between the two, both operating and influencing each other. For instance there might be both selective and random access to a social group, followed by group influence which might then 'select out' some and reinforce the beliefs and behaviours of others, this leading to conformity to the group norms in general.

In summary of the criticism, then the cross-tabulation method, grouping by Y, and self-selectivity, could singly or in combination produce falsely significant findings. Most of the studies referred to in discussing the types of

and importance of social influence for the explanation of 'regional contagion' use these methods, and should therefore be read critically and their results assessed with caution.

A final word is that though these studies assume behavioural influence, none can really test the assumption rigorously owing to their non-experimental nature.

(ii) types of social influence

In trying to explain what regional contagion represents in terms of social influence, all that can be done is to consider and assess the worth of existing theories of ecological effect upon party vote.

One suggestion is that people are motivated to conform to perceived community norms (Campbell, 1958). This assumes that they identify with a community and can perceive community standards. It draws upon reference group theory in psychology (Putnam, 1966). Putnam has analysed this effect and claims it to be not proven, but there are weaknesses in his operational definition of community identification, and in some uncontrolled selectivity. If the effect holds, then there could be a regional component to it corresponding to regional contagion. There is an opportunity here to use some of the perception methodologies in geography purposefully.

A second suggestion is that ecological political influence is mediated by both formal and informal contacts - through friendship groups or voluntary organisations (Putnam, 1966; Ennis, 1962; Segal and Meyer, 1969; Cox, 1969). Cox (1969) further differentiates these effects according to geographical scale, and suggests that people belonging to areally extensive organisations are less influenced by the local community. To explain the regional contagion effect, this would suggest that more people in both very high and very low status nodal areas belong to areally extensive organisations - a doubtful hypothesis. However people in peripheral parts of a region could belong more to organisations with their center or origins in the region. Also informal contacts from these peripheral areas

(perhaps related to life-cycle movements) could be more oriented to the region. If the methods used in the studies quoted are revised to group by the independent variable and to control for selectivity, then these effects would be better analysed.

A third consideration is that certain religious and ethnic groups (e.g. Roman Catholics and Jews) have their own form of group influence, and this may work against the local community influence. This would account for some anomalies in Melbourne and Sydney where areas of Jewish concentrations vote more for the ALP independent of the local socio-economic status level (section 6 above). The Roman Catholics traditionally vote either for the ALP or for the DLP, and in the factor analysis for this thesis, Roman Catholicity loads mainly upon low socio-economic status. What the combined effects of these facts are is unknown. To explain the regional contagion effect then more Roman Catholics and Jews would have to be located at the periphery of ALP voting regions, and in the center of non-ALP voting regions. The partial correlation of aggregate data for city regions would analyse these effects, if any.

A fourth idea develops from the suggestions of Segal and Meyer (1969) about the effects of the town political climate upon the influence of the local neighbourhood in affecting individual voting. Substituting 'city region' for 'town' then the suggestion is that the local neighbourhood area influences individual voting more where city regional concensus is weak (i.e. where the region is not strongly of one or another party, cells e and f, Fig. 16) and influences it comparatively less where regional concensus is strong (cells a and b); the local area still has influence in either case. This could be the situation for non-major regions in the city - the local effect having importance without any real regional effect (i.e. no type A or B relationships).

The inverse of their finding gives another hypothesis: it suggests that where there is a weak local concensus, then there will be more influence from the strong concensus region. This of course fits in well with type A relations

(regional contagion). It requires (i) medium range %ALP vote, (ii) peripherality to a major region. In this case the regional status influences individual voting to a relatively greater extent than does the local status level. It would give the continuous gradient of type A relations from the major regional nodes.

To test the hypotheses from the fourth idea then one would either need three areal scales of aggregate data, or individual data plus two areal scales of aggregate data. In the first case the differing ecological effects at different areal scales upon the small areal aggregates would be analysed, and in the second case the influence of the ecological effects at two areal scales of aggregate data upon individual behaviour would be analysed.

15. Two distributions

a) frequency polygons

For the %ALP frequency distributions (figures 7a and 8a), it is plain that for each city there are two distributions rather than one; the frequency polygons show a distinct split at about the average %ALP vote for each city. These distributions are the two-dimensional representations of the geographical pattern of %ALP regions. The major regional nodes are located at the extreme tails of the frequency polygons, and the effect of socio-economic status and regional contagion (type A relations) upon the %ALP vote is such that the numbers of electoral divisions with either moderately high or moderately low ALP voting are increased, giving the bimodal distribution. As figure 15a shows, there should be a distinct split in the %ALP vote between regions at their join, and this is reflected in the frequency polygon split.

The socio-economic status distributions (figures 7 and 8) also show some slight bimodality and skews, but it is apparent that the ALP vote has amplified any such variation into distinct bimodality and major region dichotomies for each city.

b) group-anchoring

McPhee and Ferguson (1962) give two main reasons for political immunization, the first being personal commitment after repeated decisions, and the second being group anchoring - the mutual reinforcement of existing choices over time. The first reason is an entirely personal process, whereas the second is a process of group influence. It may be added that the influence may have spatial or aspatial components, and may be for long or short time periods (though they assume long periods).

Their model assumes mutual reinforcement when individuals "discover they agree" (p.169), which in a geographical sense means influence from ones own social region (as well as any aspatial influence). Their model does not account for social dissonance, migrations, or changing party affiliations, and it could be expanded to include a regional contagion type of social influence in which some individuals are converted to the party affiliation associated with their social region.

If this is done then the 'group anchoring' concept now has two components. The first (the original) is a group process towards stability of existing choices, and this ties in well with the idea of selective migration to social areas. The second is a group process towards changing individuals who enter the group (or social area) to become more like the group. Both processes can occur, and it is of interest to know the proportions of each form of influence, and their variation over time, place and context, etc.

It is not adequate to say, as McPhee and Ferguson (1962) do, that the reasons for continuing group affiliations are in the remote past. Some allowance for changing affiliations and migrations must be made, and the above mentioned expansion of their concept does this.

It is noted in passing that their bimodal distribution (which unfortunately is based upon recall data) for individual party choice could, as they are aware of, be caused by a number of processes. Even individual data

from Gallup Polls will contain the influence of spatial aggregates if the "individuals'" behaviour sampled had been influenced by their location in a spatial aggregate. Their distribution could have been caused not only by individual immunization, but by the expanded process of group anchoring.

CHAPTER VII

OTHER VOTING PATTERNS

In this chapter participation and the informal vote are examined both for the whole city and for city subregions. The ALP vote is then included with these and their combination patterns for the cities are described.

1. Participation

It is often of interest to know where most people turn out to vote, and to understand why there are differences in turnout. It may seem odd to analyse this in Australia, where Federal voting is compulsory, but distinctive urban patterns emerge nevertheless, and these have some relevance to overseas studies as well as to Australian voting behaviour.

There is on average a 95% turnout for Federal elections in Australian cities, with a standard deviation of about 1½%. Taking into account a skew towards the lower percentages, most figures fall within the range of 91% to 97%. The figures given by Cox (1968) for London in 1951 are a mean of 81.35% and a standard deviation of 4.34%. By counting the number of constituencies in his four categories (p.115), it is apparent that his distribution was skewed geographically towards the city center.

Whilst the absolute magnitude of the Australian percentages reflect the coerced vote, it is both the profile and the geographical pattern of their distribution which is of interest, and which apparently reflects distinctive urban sociological distributions which are common to Sydney, Melbourne, and London.

It is postulated that there are two components in the cause of a lack of turnout, (i) technical reasons such as illness or address change, (ii) sociological reasons such as lack of interest or alienation. The first component is termed 'technical' although it is likely to be an indirect result of sociological patterns. With an average of only

5% of the electorate not voting in Australia, it could be expected that the first component would be quite important. Whilst the relative proportions of both components are unknown, an attempt has been made to estimate their different patterns.

The first measure of participation used is that given in the Electoral Returns, and is "the percentage of electors to whom ballot papers were issued to the number of electors enrolled". Going by written descriptions, it is the same measure as used by Cox (1968) in London.

2. Correlations with participation

The simple, full city correlations with participation are given in table 13. The best single predictor is city centrality, indicating that the inner city sociological patterns account for the greater proportion of non-voting in the cities; socio-economic status has no correlation with participation.

These correlations and the maps of participation (figures 9d and 10d) show that the distribution of participation in Sydney and Melbourne is similar to that in London, if only in gross aspect.

In Melbourne the correlation is linear but heteroscedastic, i.e. both participation and city centrality have skewed distributions, giving a spoon-shaped bivariate plot in which the 'handle' is the skew towards the city center and towards low participation (figure 18b). Sydney has a similar distribution, but it is much more scattered (figure 18a). The heteroscedasticity means that the correlation is stronger in the inner city and weaker in other areas. The inner city becomes a distinctive subregion in relation to participation and can therefore be contrasted to the outer city as an additional form of analysis.

In Melbourne the correlation of $r = -.925$ with city centrality represents an 86% variance explanation, and the residual from this correlation does not correlate highly with any independent variable used in the study.

	%ALP	%P	IδnC	SO$ II	LCS II	SO$ III	LCS III	CC III	dCBD	SS
%ALP		-.009	.607	.898	.060	.917	.069	-.163	-.092	-.175
%P	-.194		-.599	-.102	-.786	.133	-.398	.794	.746	-.463
IδnC	.775	-.618		.738	.413	.563	.115	-.663	-.426	.252
SO$ II	-.796	-.064	-.595		0.0	.928	-.130	-.349	-.045	-.127
LCS II	.422	-.868	.724	0.0		-.096	.822	-.561	-.915	.292
SO$ III	-.851	-.169	-.540	.781	-.132		0.0	0.0	.026	-.274
LCS III	-.110	-.142	-.077	.603	.418	0.0		0.0	-.777	.059
CC III	.396	-.925	.762	-.166	.899	0.0	0.0		.488	-.387
dCBD	-.457	.671	-.617	-.016	-.913	.276	-.577	-.707		-.411
SS	.238	-.197	.341	.020	.402	-.189	.347	.258	-.563	

Table 13. Voting and social variables intercorrelations, for Sydney above the diagonal, and for Melbourne below the diagonal. Index for abbreviations as in tables 4, 6, and 12 (SS = seat safety).

II = Two factor solution

III = Three factor solution

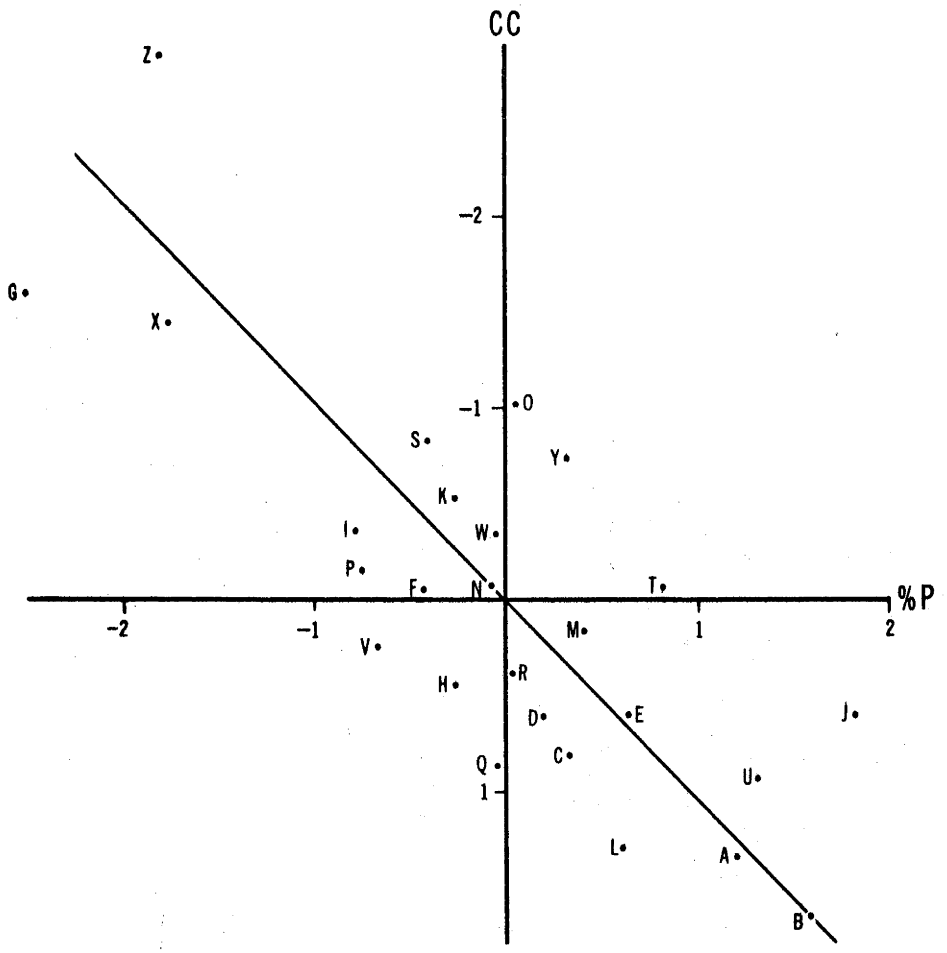

Fig. 18a. Sydney: Participation and city centrality

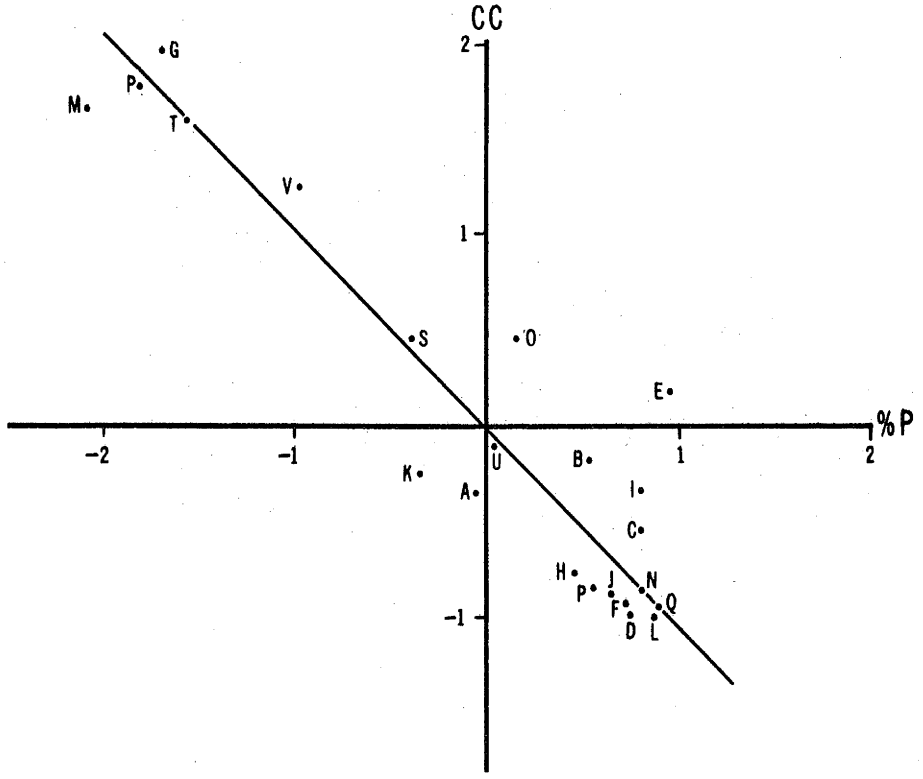

Fig. 18b. Melbourne: Participation and city centrality

In Sydney participation again has a high correlation of r = .794 with city centrality (factor signs are reversed between cities), but there is also a correlation of r = -.398 with life-cycle stage (three factor). Together they give a multiple R of R = .888, or 79% variance explained. The residual from this multiple correlation does not correlate highly with any other independent variable used in this study.

In Melbourne, a plot of the residual upon city centrality, and in Sydney a plot upon the multiple participation estimate, did not produce any sub-population linear trends, or any other discernible non-random pattern, and so regional contagion of participation was assumed not to exist.

3. Participation and seat safety

It has been observed (Prescott, 1969; Butler, 1961) that there is sometimes a correlation between participation and the safety of a seat, with implications that the safer a seat is, the less people are inclined to turn out to vote. In Australia, of course, there is the extra consideration of compulsory voting, and whilst one cannot directly analyse the effect of this, the interrelationships between participation, seat safety, and city centrality can be analysed within the Australian context.

a) partialling city centrality

The three variables were approximately multinormal for Sydney, though curvilinear relations between seat safety and both participation and city centrality in Melbourne led to the log 10 transform of the latter two in order to be able to use partial analysis appropriately.

When city centrality and seat safety are alternately partialled from the remaining pair (table 14), it is apparent that in Sydney city centrality explains most (62%) of the variance between participation and seat safety, whilst seat safety explains only 10% of the variance (footnote 3, ch. 6) between participation and city centrality. In Melbourne the small correlation between seat safety and the log transformed participation was reduced to zero when the log transformed city centrality was partialled out, whilst

seat safety explained none of the variance between participation and city centrality.

Sydney

Variables	r	r^2%	Variables	r	r^2%
12	-.463	21%	13	.794	63%
12.3	-.277	8%	13.2	.752	57%
12.24	-.228	5%			

1 = participation
2 = seat safety
3 = city centrality
4 = socio-economic status (three factor)

Melbourne

Variables	r	Variables	r	r^2%
12	-.229	13	-.805	65%
12.3	.021	13.2	-.793	63%

1 = Participation (log transform)
2 = seat safety
3 = city centrality (log transform)

Table 14. Analysis of the importance of seat safety for participation

These correlations suggest that seat safety is partly a surrogate for city centrality, and that no allowance should be made for seat safety when analysing participation. When the plots of participation upon seat safety are examined, this suggestion is supported (figures 19a and 19b).

b) geographical explanation

Although the plot for Sydney (figure 19a) shows a scattered distribution, two approximate linear and geographical trends can be seen (indicated on the plot).

The first trend is one from the outer city (south and southwest) at group C, to the inner city (central, eastern and northern) at group D. There is so direct relation with socio-economic status in this trend.

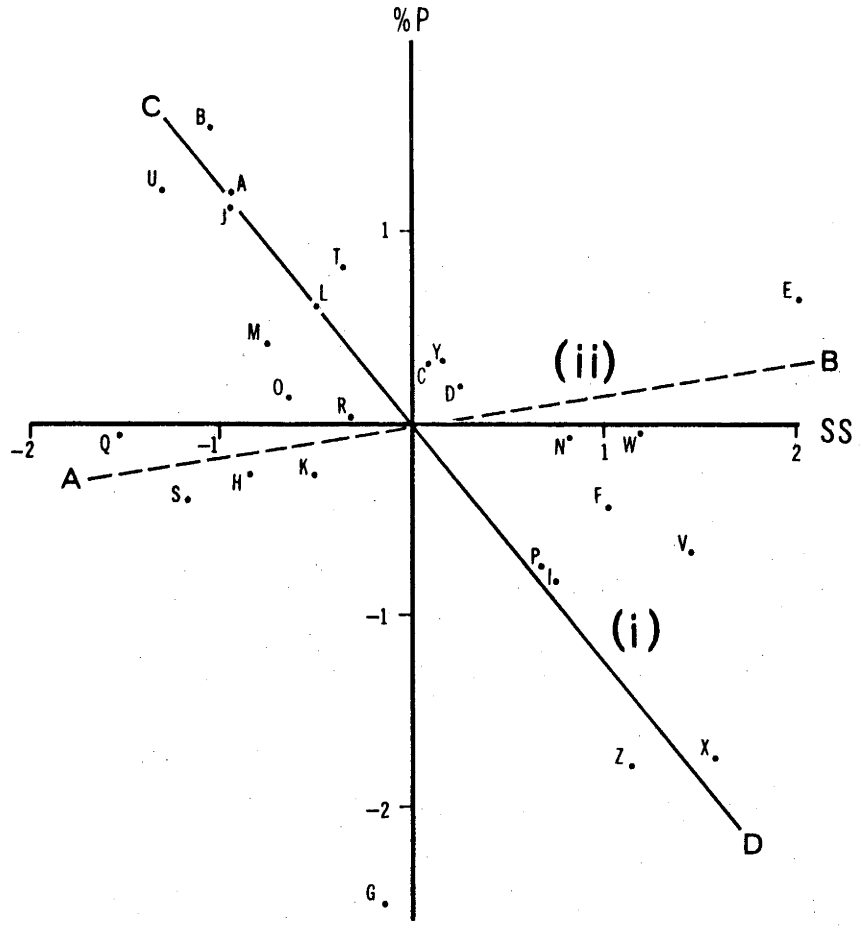

Fig. 19a. Sydney: Participation and seat safety

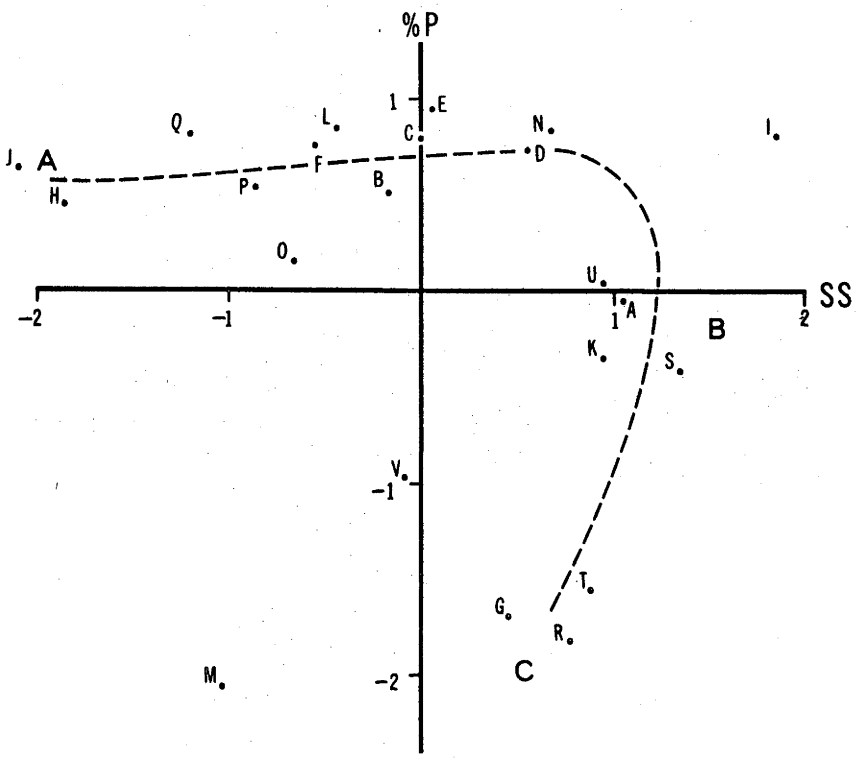

Fig. 19b. Melbourne: Participation and seat safety

The second trend is one of medium range socio-economic status in the inner western, outer northwestern, and south-western suburbs at group A, to an unclear pattern at B (the B group has the highest status division which is in neither an inner nor an outer region; there is possibly a central-southern, and a northern peripheral division in the group also).

There is an isolate, G, at the low end of the participation axis which is geographically located between members S and K, and Z and X, of groups A and D respectively.

It is the first trend which accounts for the correlation between the two variables, and this is an inner versus outer city trend. When the inner-outer city trend is controlled for by partialling city centrality, then the correlation is reduced by nearly two thirds (section a, above).

Melbourne also has a scattered plot, which in general is curvilinear (figure 19b).

One end of the curve is located in the outer city at group A, and the other in the inner city at group C. There is no direct relation with socio-economic status for this curve.

Group B consists of either high or low socio-economic areas which are neither inner nor outer city (S here compares with W in Sydney, in being a major industrial area and also in not being very strong in city central sociological characteristics).

As with Sydney, there is an isolate, M, near the low end of the participation axis (this one lies geographically between the B and C groups). In both Sydney and Melbourne, the isolates - East Sydney (Paddington-Wollahra) and Isaacs (St Kilda) - are areas of inner city older housing with mixtures of fashionable renovations and high density flats; both have a high electoral turnover.

As with Sydney again, the main trend is from inner to outer city, and hence its explanation by city centrality. The trend is more extreme in Melbourne, in the curvilinear sense, being the result of the stronger skew there of both

participation and city centrality towards the inner city.

c) other variables

The results of partialling out life-cycle stage (two factor) and distance from the CBD from the correlation between participation and seat safety are given in table 15. By comparing with table 14, it can be seen that city centrality is the better explanatory variable, though there is little difference between city centrality and distance from the CBD in terms of a variance explanation. City centrality is chosen because of its social meaningfulness in explaining the correlation.

Sydney

Variables	r	r^2%	Variables	r	r^2%
12	-.463	21.4%	12	-.229	5.2%
12.4	-.395	15.6%	12.4	.142	2.0%
12.5	-.257	6.6%	12.5	.145	2.1%

1 = participation
2 = seat safety
4 = life-cycle stage (three factor)
5 = distance from the CBD

1 = participation (log transform)
2 = seat safety
4 = life-cycle stage (three factor)
5 = distance from the CBD

Table 15. Other variables, seat safety, and participation

d) conclusion

In spite of compulsory voting in Australia, these results suggest that any correlation between participation and seat safety is spurious, and that it is spurious because of the geographical patterning of some safe and some unsafe seats. In the two Australian cities and for the one election, a significant proportion of the safe seats were in the inner city, and a significant proportion of the unsafe seats were in the outer city, and it was the sociological characteristics of these regions which explained the participation differences, not the safety of the seat.

In Sydney 8% of the variance between participation and seat safety remains unaccounted for. Whether or not this is random variance or whether there is some causal influence is unknown. Because city centrality greatly reduces the correlation, and because the correlation is zero in Melbourne, it was decided to treat it as being random, rather than to subtract it from the participation measure.

As Prescott (1969) has indicated, the relationships between participation and seat safety need to be explicitly analysed. It would be particularly interesting to find out if similar relationships held where voting was not compulsory.

4. The components of participation

The original participation measure used is the "percentage of electors to whom ballot papers were issued to the number of electors enrolled". But, because there will be some systematic differences in the accuracy of the rolls at election time, then the original participation measure will be partly one of roll inaccuracy. The electorates with high residential turnover are likely to have the most inaccurate rolls; where there are more persons on the roll who no longer live in an electorate, then the percentage of persons to whom ballot papers were issued to those on the roll will be comparatively lower than if the electoral roll was accurate.

If electoral turnover could be controlled for, then a more appropriate basis for the variation in participation could be looked for. It might be that the areas of high electoral turnover correspond to areas in which people are sociologically less inclined to vote, but the analysis of interrelationships should still be made. This at least was the initial simple assumption, but the separation of the technical from the social reasons for non-voting is not so simple.

a) turnover and the rolls

In Australia the rolls are checked about once a year by house to house enquiry. Whilst an attempt is made to make the check as close as possible to a forthcoming election,

the government does not always give sufficient forewarning (for party political reasons) to make the check possible. Even when the check is possible it is such a lengthy process that months may pass between the checking of a household and the election (the reference for most of this information is the author himself, who worked in the Electoral Office in N.S.W. for two years).

The rolls are closed about a month before the election so that there is an additional period when people may move residence but may not be re-enrolled. In these cases they are informed (if they send in notification) that they must vote on the basis of their old address, by section or postal vote if necessary. Whilst many will do so, some will not. Importantly, some of those who have moved will not be concerned with registering their address change, nor with voting. No action is taken by the Electoral Office usually upon cases of non-voting because of address change at election time.

b) roll accuracy for participation

For the Federal election on the 26th November, 1966, the rolls were closed 25 days beforehand on the 31st October. There are three major reasons why, after this date, there would be names on the roll representing persons who did not vote for technical reasons, and these are (i) residence change, (ii) death, (iii) infirmity, hospitalisation, and convalescence. Both (ii) and (iii) are likely to vary geographically with the old age variable, whilst (i) would have some correlation with life-cycle stage and city centrality.

The Registrar General supplies a monthly list of marriages and deaths to each electoral officer, and so the rolls are comparatively accurate for deletions due to deaths. It is the responsibility of the elector is he changes address to notify the electoral office, and so considerable time lags often exist for address changes. However, although the rolls are less accurate for addresses, an elector can still vote by section or postal vote for his old address, as can the hospitalised, etc., whereas the

deceased (obviously) cannot. It is not known what proportions of electors who, when they are living at an address different to that given for them on the rolls, vote on the basis of their old address, and what proportion do not vote. Nor is it known what proportion of the hospitalised etc. make use of the postal vote.

c) 'names removed' variable

The dilemma is to find an appropriate variable which will cover the technical reasons for non-voting whilst leaving the other sociological reasons for non-voting free to vary. Unfortunately the published electoral statistics are not broken down finely enough to permit a very accurate analysis, though an estimate is possible.

A summary of roll operations effected for each Federal division for the year ended 31-12-66 was published as a document for the electoral office. This document gives the number of names removed[1] during 1966, and the number of names on the roll at 1-1-66, and from this the years percentage of name removals can be obtained for each division.

d) deaths and names removed

The percentage names removed during the year includes deaths as well as address changes, but the rolls are more accurate at election time in regard to deaths.

The result is that the yearly total of names removed will contain a proportion of deaths higher than that which would contribute to roll inaccuracies at election time. This excess of deaths could be controlled for indirectly by assuming a high correlation with age, and by then partialling age from names removed, as a surrogate for deaths.

---

1. 'Removals' for a division include movements between subdivisions, but not within subdivisions. Therefore the percentage removals of a division will include some electors who have changed address within the division.

However :

(i) there is no information on how many of those who changed their address still used the postal vote facility, nor on how many address inaccuracies on the roll were used as an 'excuse' not to vote by those basically apathetic or alienated. Consequently the numbers of those who wanted to, but did not vote out of genuine mistakenness is unknown.

(ii) If age correlates geographically with deaths, and with infirmity, convalescence and hospitalisation (no statistics are easily available), then leaving the variance due to deaths in the names removed variable will account for some of the variance due to infirmity etc. The names removed variable would then be an estimate for address changes, deaths, and infirmity as reasons for not voting at election time.

(iii) 'Age' is only partly a surrogate for deaths, it also correlates with life-cycle stage. As some address changes are due directly to life-cycle reasons, then partialling age from names removed might take out some of this wanted variance. It would also take out some variance due to infirmity.

e) components of 'names removed'

The components are as follows:

(a) deaths
  (i) actual (wanted within the variable)
  (ii) as a surrogate for illness etc. (wanted also)

(b) address change
  (i) with the elector still voting (not wanted)
  (ii) with the elector not voting by mistake (wanted)
  (iii) with the elector not voting because of apathy or alienation (not wanted).

The relative proportions of each within the percentage of names removed are unknown, but the proportion of deaths would probably be far from insignificant, and the proportion of address changes with the elector still voting would probably be large.

The latter is simply a part of residential mobility and should correlate with life-cycle stage and city centrality. If it is removed from participation along with the rest of the names removed variance, then the remainder of the participation measure should be less connected with residential mobility; if it represents 'alienation', then it would be that alienation less connected with mobility. One would expect the residual from the correlation of participation with names removed to have a lower correlation with life-cycle stage and city centrality.

In summary, 'names removed' can be reduced to three categories: residential mobility, technical reasons for non-voting, and some alienation or apathy. When names removed is subtracted from participation, the residual is the original participation minus the pattern of these categories as they are in names removed.

Thus although the variable 'names removed' seems to be too mixed to be used for very precise analysis, it still allows some suggestions to be made.

f) results

In table 16 participation has been split into two components, NR and P$\hat{o}$NR, the latter having zero correlation. The most striking feature of the table is that, with one exception, each variable correlates mostly with city centrality, so that a geographical connection between 'alienation' in voting and residential mobility in the city center seems to be likely. This would not be surprising considering the empirical and theoretical relation between the inner city area and sociological alienation.

The second feature of note is that names removed correlates substantially with both city centrality and life-cycle stage in both cities, as would be expected because of

	Sydney			Melbourne		
	CC	LCS	SO$	CC	LCS	SO$
%P	.794	-.398	.133	-.925	-.142	-.170
NR	-.593	.676	-.063	.728	.534	.339
PδNR	.513	.139	.123	-.523	.447	.273

INDEX : %P = Original participation measure
NR = Names removed
PδNR = Participation minus names removed

SIGNS :	Sydney	Melbourne	
CC	-ve inner	+ve inner	(using the
LCS	+ve inner	+ve inner	three factor
SO$	+ve low	-ve low	solution)

Table 16. Participation components correlated with sociological factors

the residential mobility implicit in these factors. Where the cities differ is in the changing relations with %P when NR is subtracted. The original %P in Sydney correlates with both city centrality and life cycle stage, but when names removed is subtracted, the residual correlates only with city centrality (to a lower degree). In Melbourne the original %P correlates only with city centrality, but when names removed is subtracted, the residual correlates with city centrality, and also in an unexpected direction with life-cycle stage. According to this result, there is low participation in the city center, but there is also low participation in the outer city.

This pattern is not as contradictory as it seems, for it involves subgroup trends; it will be dealt with more fully in the next section, but briefly, when the inner-city areas are taken out of the analysis (for both cities), then there is a weak scattered trend in the opposite direction to that for the whole city, i.e. in the outer city (where there is below average names removed and above average participation), then participation increases as named removed increases. It is the far outer, newest suburbs

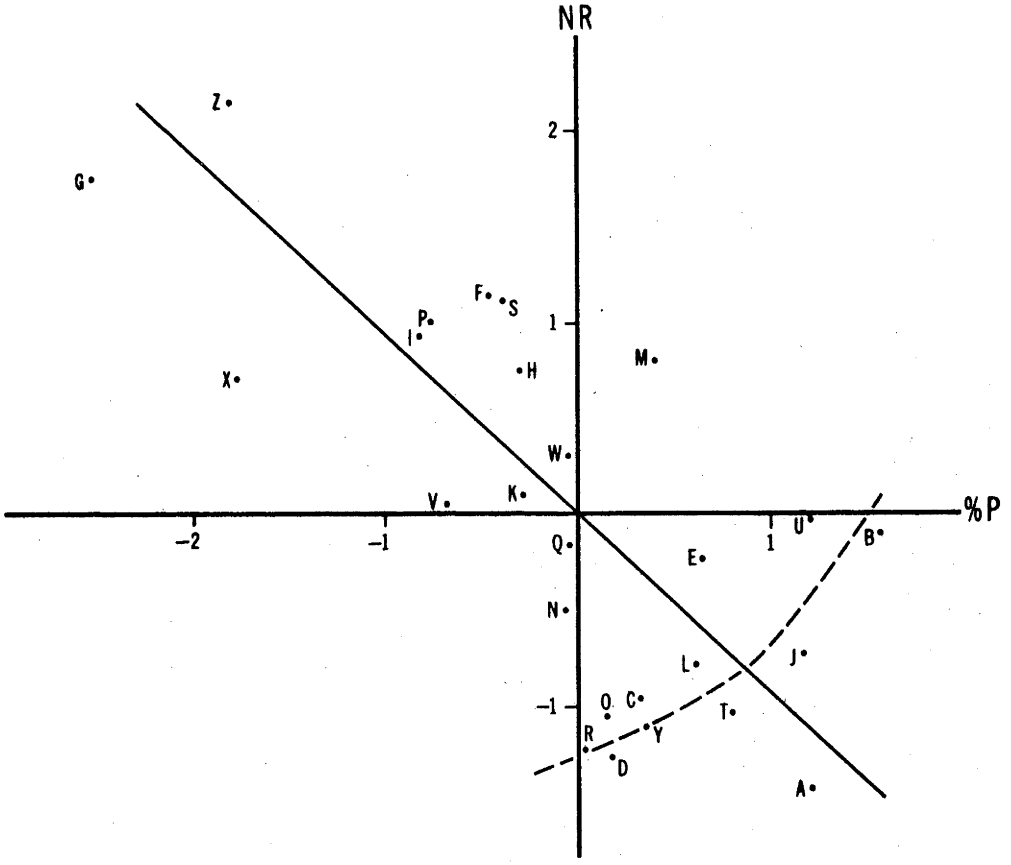

Fig. 20a. Sydney: Participation and names removed

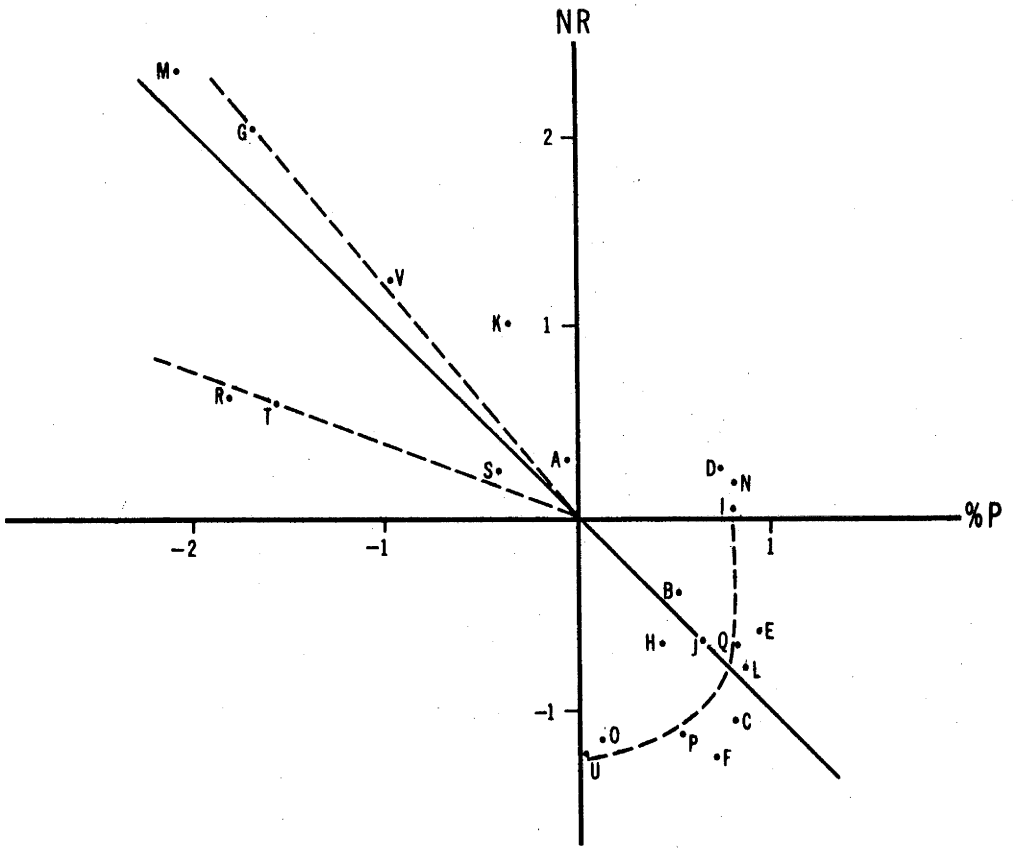

Fig. 20b. Melbourne: Participation and names removed

which have a lower participation and a lower percentage names removed than the other outer suburbs.

Why there are differences between the two cities is not fully known, but it is possibly because of the basic factor differences. The crudity of the names removed variable does not make further analysis worthwhile.

There are indications from this analysis that the social and the technical reasons for non-participation are geographically correlated in the city center, but that variations with life-cycle stage exist between cities.

5. City region comparisons for participation, names removed, and city centrality

a) inner and outer city differences

The bivariate plots for participation and names removed, and for participation and city centrality (figures 18 and 20) show variations in the relations between the inner and outer parts of each city, and whilst the differing relationships may be seen generally and intuitively, the quantification of relationships in the inner and outer city regions requires a city dichotomy.

Because the total number of city divisions is rather small, any further subdivision would make an analysis more sensitive to variation by 'sampling error', and so the method of subdivision is quite important. Using the regional grouping method with the group-mean, and with city centrality as the independent variable to be regionally dichotomised (because of its importance for participation), then two regional groups are obtained. Descriptive correlation relations within these regions will give a basis for comparing the two regions. Because of the few numbers involved, the group composition was regionally altered by a few electoral divisions to test the degree of sensitivity of the r coefficient to 'sampling', but the relations did not alter very much, apart from the participation and names removed relationship, mentioned below.

Rather than to infer probable relations for the inner city, the purpose of the exercise is to illustrate the comparative differences between the inner and outer city, and

to relate these to the full city relations between participation and other variables.

b) results

Dichotomies:

Melbourne

Inner city : RTSMGV

Outer city : ABCDEFHIJKLNOPQU

Sydney

Inner city : XSZWFGIKPV

Outer city : ABCDEHJLMNOQRTUY

Melbourne	Whole	Inner	Outer
%P & CC	-.925	-.915	-.480
%P & NR	-.822	-.658	-.456
Sydney			
%P & CC	.794	.734	.517
%P & NR	-.714	-.669	-.094

Table 17. Region comparisons for participation

Melbourne

The inner-outer difference in the %P/CC relationship is one of degree only, as given by the correlations in table 17. The differences for %P & NR are superficially similar, but the outer city has a weak, curvilinear slope reversal, so that %P decreases as NR decreases (figure 20b). This reversal is not shown by the r coefficient, although this changes from r = -.456 to r = .166 when A and K are taken out of the outer city group.

There are also two inner city linear relations differentiated by socio-economic status; the low status trio has fewer names removed for similarly low participation.

Sydney

The inner-outer differences are similar to those of Melbourne though the plots for Sydney are more scattered (figures 18a and 18b). In the outer city the southern electoral divisions have the higher participation and the

western and northern have the lower participation. The %P/NR plot in the outer city shows a distinct reversal of trend for selected groups - the western outer suburbs being low in both names removed and participation, and the southern suburbs being high in both. The relationship is not shown by r because of the group selectivity.

c) both cities

The slope reversal in the outer city occurs for %P & NR but not for %P & CC. One explanation is that the newest suburbs are likely to have the fewest address changes or deaths, but if they are housing comission (or 'council house') type estates then they are likely to have more city central sociological characteristics and therefore less participation. Many occupants of these estates would have either migrated from the inner city or would have been selected on the basis of similar sociological characteristics (an example being the Green Valley estate in western Sydney). This would explain the south/west differences in the outer suburbs of Sydney. The distribution of city centrality does show a small rise above the average in western Sydney and in north-western Melbourne (figures 9d and 10d), i.e. in those divisions where the relative reversal of the %P & NR relationship is observed.

6. City region comparison for the three participation variables and the three sociological factors

a) whole-inner city differences

Melbourne

Whereas %P correlates with city centrality for the whole city (table 13), in the inner city it also correlates with life-cycle stage and socio-economic status, participation increasing as socio-economic status decreases (table 18). When city centrality is partialled from the latter correlation, it becomes near-zero. NR increases as socio-economic status increases in the inner area, but life-cycle stage is less important for it there. Correspondingly, the pattern of PδNR for the inner city is predicted almost entirely by life-cycle stage, which has a gradient of inner low to outer high

	Melbourne			Sydney		
Inner	CC	LCS	SO$	CC	LCS	SO$
%P	-.915	.531	-.673	.734	-.345	.177
NR	.600	.233	.954	-.754	.377	.334
PδNR	-.690	.907	-.061	.256	-.044	.411
Outer						
%P	-.456	-.180	-.233	.517	.053	.091
NR	.035	.846	.205	.133	.592	-.392

Table 18. Regional comparisons for participation variables and sociological factors, for the inner and outer city areas (signs as in table 16)

within the inner city area, with city centrality being a substantial secondary predictor. PδNR is computed for inner city divisions only.

Sydney

Sydney shows little difference in the correlations for %P between the whole and the inner city (tables 13 and 18), but NR correlates with socio-economic status in the inner city in a direction opposite to its counterpart in Melbourne (name removals increasing as socio-economic status decreases). Socio-economic status is more important for PδNR in the inner city, with the participation residual increasing as socio-economic status decreases, but city centrality is less important.

For both cities it is clear that the inner city differs from the whole city but that, apart from the greater

importance of socio-economic status for both cities, there are no important between-city similarities. This may be due to the sociological pattern differences between the two cities.

b) inner-outer city differences

Melbourne

In the outer city the %P relations are similar to those for the whole city, though weaker; life-cycle stage and socio-economic status are important in the inner city, though they are not so in the outer city.

The pattern of NR correlations is reversed in the outer and inner areas, correlating with life-cycle stage, but not with city centrality or socio-economic status in the outer city.

Sydney

In the outer but not inner city, %P correlates with CC only. NR correlates weakly with both life-cycle stage and socio-economic status, the latter correlation having a different sign in the different regions.

For both cities the outer city patterns are similar, but the inner city patterns differ firstly in the weightings of life-cycle stage and city centrality, and secondly in the importance and direction of the socio-economic status relations.

c) importance of the inner city

The significance of the inner city differences needs further examination for they obviously contribute to the differing whole city relations, and therefore effect the

validity of any inferences drawn from the whole city analyses. More importantly, if non-participation is primarily a function of inner city variables, then there is a need to identify explanitory variables there.

By significance test, then the correlations %P and CC, and NR and SS for Melbourne, and NR and CC for Sydney are significantly different (.05 level) between the inner and outer cities. The analysis is however out of the scope of the common sample → inference procedure and the results are assessed descriptively and in terms of hypothesis generation. The small numbers used make even this quite tentative.

It does seem that important differences exist between inner and outer city regions for both cities, and that the difference between cities is in the nature of the inner city areas.

For the sociological factors this has been discussed briefly in chapter 5, section 2d. It will be noticed from table 13 that life-cycle stage (two factor) in Melbourne correlates primarily with city centrality (three factor) and secondarily with life-cycle stage (three factor), whilst the primary and secondary correlations are reversed for Sydney. So firstly it should be recognised that the factor structures are not equal, but for simplicity have been given equal names in both cities because of the similarity of the geographical location of their high loading variables. Whether or not the participation relations would still be different if the factor structures were identical is unknown.

The geographical location of non-participation is relatively invariant (the skew in Cox's 1968 study suggests the inclusion of London in this proposition), though for this study the factors predicting it varied considerably between the two inner city areas. Therefore there is a need

to use areal units at a finer scale there, and there is also a need to select more variables which geographically peak in the inner city area, to be used in a more finely differentiated factor matrix (one could restrict the matrix to the inner city area). This would exclude the errors of crudeness, freeing the analysis of morphological relationships from some uncertainties of method.

7. Informal vote

a) whole city

From the full city correlations in table 13, the informal vote is seen to correlate with city centrality (three factor) and socio-economic status (three factor) in both cities. Whilst life-cycle stage from the two factor solution correlates highly, the three factor solution shows that it is the city centrality component of this which is most important. The informal vote increases as city centrality increases and as socio-economic status decreases.

Multiple correlations are given, where

1 = IδnC (informal vote minus candidates variance)
2 = LCS II
3 = SO$ II
4 = CC III (log 10 transform in Melb.)
5 = SO$ III

then,

Sydney

		R^2%
$R_{1.23}$	= .846	(72%)
$R_{1.45}$	= .870	(76%)

Melbourne

$R_{1.23}$	= .937	(88%)
$R_{1.45}$	= .941	(89%)

There is little difference in whether the two or three factor solutions are used in the multiple correlations, but as the three factor solution is more precise in specifying the city centrality distribution, then it has been used in correlation and in the regression transformation. A considerable amount of the variance of the informal vote has

been explained in both cities, and the residuals from the multiple correlations did not correlate highly with any other variable in the study. A plotting of the residuals upon city centrality, socio-economic status, and the multiple regression estimate did not produce any sub-population linear trends.

Because city centrality and socio-economic status both contribute to the informal vote, an analysis of the correlation relations in two and in three city subregions was made; the dichotomy was based on city centrality alone, and the trichotomy on both city centrality and socio-economic status.

b) inner and outer city

	Inner		Outer		Whole	
	Syd	Melb	Syd	Melb	Syd	Melb
SO$ II	.790	-.713	.832	-.683	-.738	-.595
LCS II	.381	.029	-.179	.568	.413	.724
CC III	-.570	.119	-.465	.789	-.663	.762
SO$ III	.691	-.534	.697	-.738	.563	-.540
LCS III	.048	-.855	-.286	-.150	.115	-.077

Table 19. Correlations of IδnC with sociological variables, inner, outer, and whole city (signs as in table 16).

Using the city centrality dichotomy already defined (section 4b above), the correlation relation relations for IδnC were examined and little difference was found between the whole, inner, and outer city r coefficients (table 19). The only serious deviation was for the Melbourne inner city, and this again seems to be one of weighting differences in the factor composition of city centrality and life-cycle stage.

c) three city regions

The regional grouping method was used to obtain three regions which were combinations of city centrality and socio-economic status (three factor) for both cities, and the

relations in the section above were compared between these regions. The grouping method combines the values of both factors in deriving regions, and these regions are given below:

Sydney		Melbourne	
Northern :	CENOPRTUY	Western :	BEIOQRSTUV
Southern :	ABDFHIJLMQUW	Central :	ADGKMN
Eastern :	GKSXZ	Eastern :	CFHJLP

	Sydney			Melbourne		
	Nth	Sth	East	West	Cent	East
SO$ II	.832	.890	.701	-.696	-.870	-.727
LCS II	-.228	.475	.696	.515	.868	-.114
CC II	-.819	-.546	-.843	.667	.896	.872
SO$ III	.762	.909	.587	-.073	.446	-.012
LCS III	-.399	.359	.257	-.385	-.793	-.494

Table 20. Correlations of $I^{\delta}nC$ with sociological factors, three city regions (signs as in table 16)

Sydney showed some weighting variation between city centrality and life-cycle stage, the latter changing sign in the northern and southern regions; socio-economic status was very important in the southern region, contrasting to the other regions and the whole city.

In Melbourne there was a reversal in the importance of socio-economic status and life-cycle stage (three factor) between the whole city and the three regions. Although life-cycle stage (three factor) had no correlation with informal vote for the whole city, it correlated negatively in each region. The positive correlation with socio-economic status (three factor) for the whole city was reduced to zero for two regions and made positive in the central region.

It is apparent that a simple or multiple linear correlation for the whole city does not do justice to the regional variation in relations with the informal vote, and that as with participation, the whole city regression is

appropriate for inferences based upon the whole city only.

d) Melbourne central area

The inner city dichotomy region and the central city trichotomy region for Melbourne both overlap but are not identical. Both contain a similar 'contrary' relation between socio-economic status and participation and the informal vote respectively, participation decreasing and the informal vote increasing as socio-economic status increases. Whether this is due to an inadequacy of method, or to an aggregate pattern of behaviours and social characteristics mixing as observed is unknown and has not been further analysed. Given the existing measures, and assuming that the pattern of city centrality in the region contributes to the positive correlation between socio-economic status and the informal vote, then when city centrality is partialled from this correlation, it changes from $r = .446$ to $r = -.379$. For the inner city dichotomy area, the correlation os $r = -.635$ between participation and socio-economic status becomes $r = .169$ when city centrality is partialled out. In both regions there is an approximately 40% covariation of city centrality with socio-economic status ($r = .620$ for the dichotomy and $r = .678$ for the trichotomy region).

Thus within these regions city centrality characteristics increase as socio-economic status increases, and this contributes to the 'contrary' patterns observed. However, the data is aggregate, the areal units are large, and the 'sample' is small, and so there is a possibility that the relations are a function of inadequate analytic design, i.e. they hold for the few large units, but may drastically change if based upon smaller areas.

8. The components of informal voting

The percent participation figures included the technical and sociological non-voting behaviour, and the informal voting figures also include accidental and deliberate informality. A crude estimation of the proportions of the deliberate and accidental informal vote is possible, and this estimate suggests that for the measure used for the

1966 election, the deliberate informal vote predominated (one would expect this because of the subtraction of the variance due to the number of candidates).

The only detailed information available on types of informal voting is given for N.S.W. divisions for the Senate election of 1949 (presented by R.W. Evans to the Senate Select Committee on the Constitution Alteration (Avoidance of Double Dissolution Deadlocks) Bill, Commonwealth Parliamentary Paper S1 1950, p.25-27). The obvious drawbacks are the variations in voting for the Senate and House of Representatives, and the election sample of one - and that for 17 years before 1966. Although the informal vote for the Senate is about five times that for the House of Representatives elections, an assessment can be made of the magnitude of the deliberately informal vote. It is assumed that because there are a very large number of candidates for the Senate (23 in 1949), most of the informal vote is accidental (at $\frac{1}{4}$ to $\frac{1}{2}$% for each candidate, this gives 6 to 11%).

A table in the Parliamentary Paper gives the breakdown in the types of informal vote, and from these the deliberately informal vote was taken to be those ballot papers either completely unmarked, or with a line drawn through, or with funny or other writing on them. A selection was made of the remaining categories to give the clearly accidental vote (for the table in the Parliamentary Papers these are sections 2c, 3c, 4bcde, 5abcd). The appropriate categories were summed for the metropolitan divisions and made a percentage of the divisional total informal vote. The correlation between the two measures was r = .68, or about 50% variance overlap.

a) relevance for 1966

In the 1949 Senate election, 11.2% of the total vote was informal, and a minimum of 1.3% was deliberately informal (from the tables in the Parliamentary Papers). In the 1949 House of Representatives election the total informal vote was 2.2%, and if a similar number voted deliberately informal for both House and Senate, then the proportion of deliberate

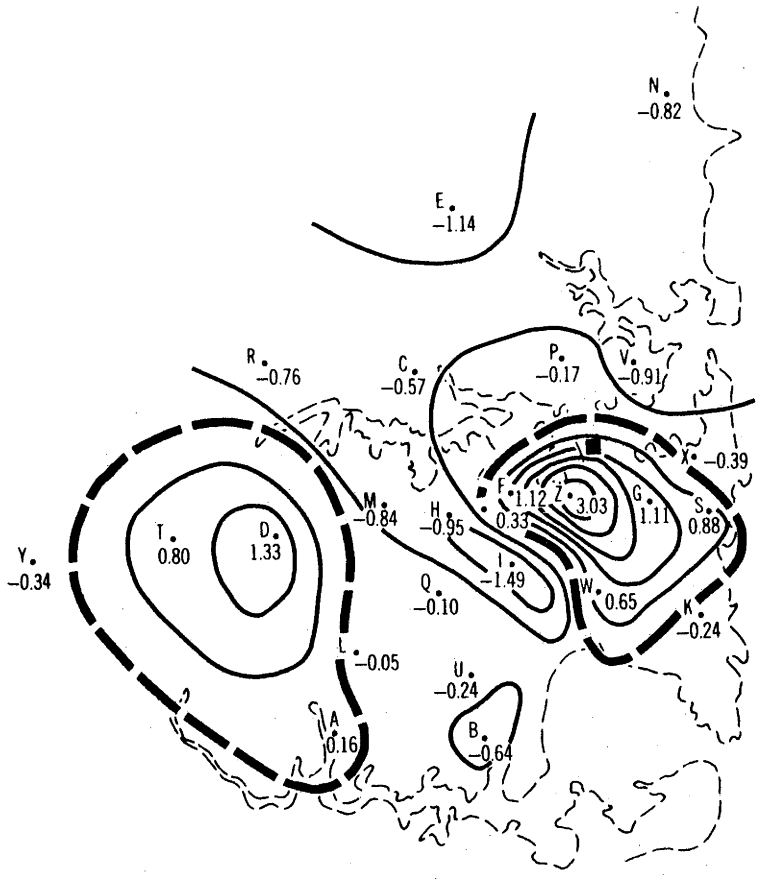

Fig. 21a. The 1949 Senate deliberate informal vote as a percentage of the total vote in standard form

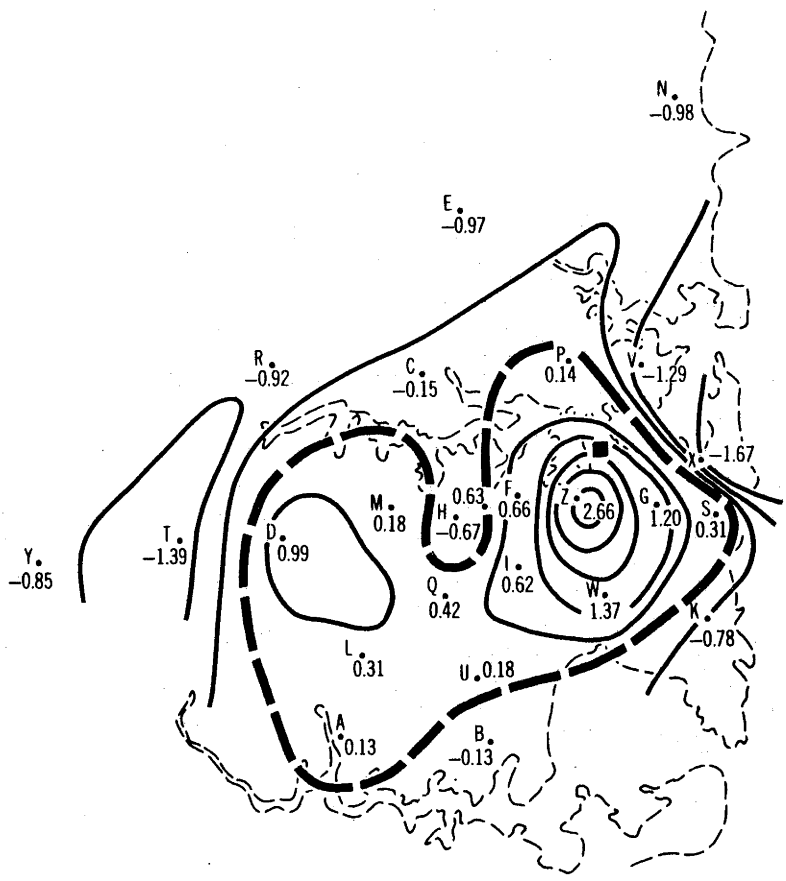

Fig. 21b. The 1949 Senate accidental informal vote

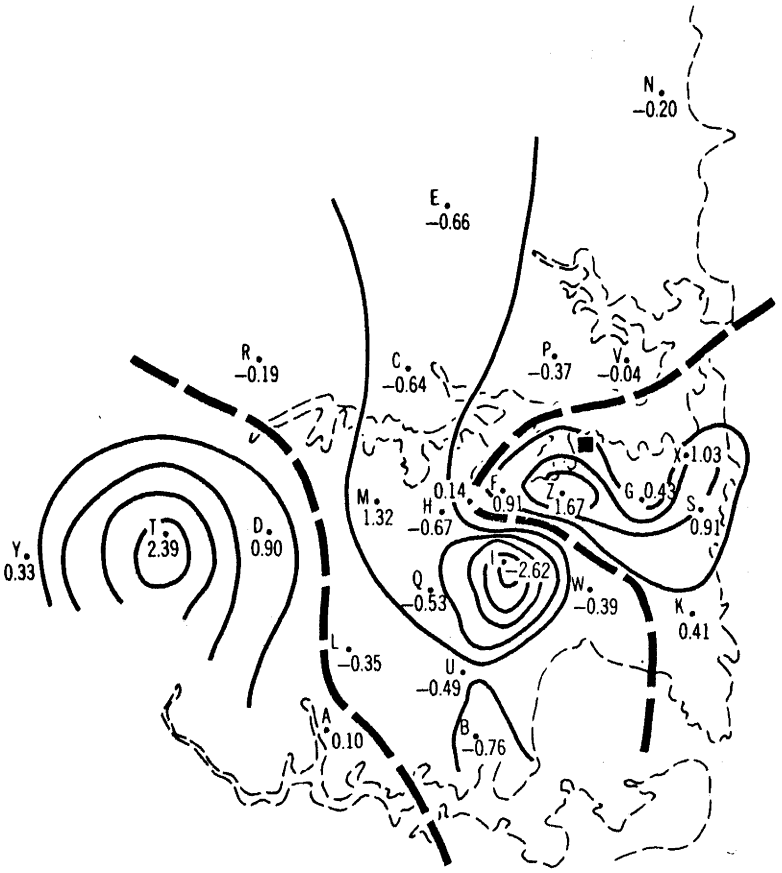

Fig. 22a. Deliberate informal vote independent of accidental informal vote

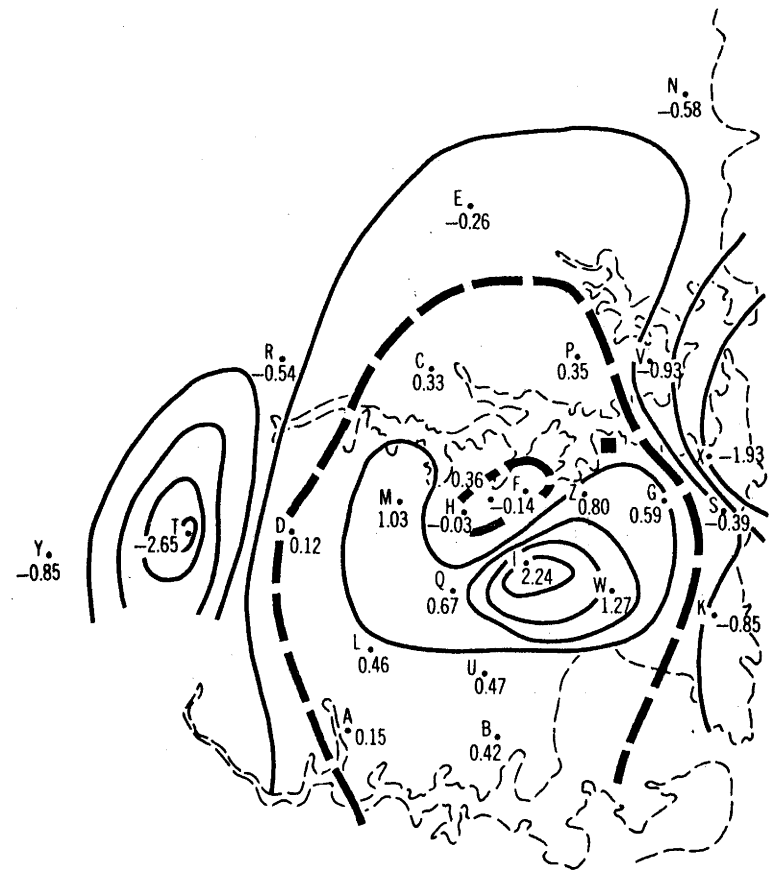

Fig. 22b. Accidental informal vote independent of deliberate informal vote

informal voters for the House in 1949 would at first seem to be about 1.3/2.2 or 58%. However, firstly because of the larger number of candidates and the greater lack of interest for Senate elections, the absolute magnitude of the deliberately informal vote could be greater, and this could reduce this percentage. Secondly, it is known that the number of candidates influence the size of the informal vote, this presumably being an error contribution. If the figure of 2.2% for 1949 is corrected for the influence of the number of candidates by subtracting $\frac{1}{4}$% for each candidate per division, the average is reduced from 2.19% to 1.46%, and the new deliberate vote estimate becomes 87%. Using the regression transformation as used for 1966 data, the correlation between the number of candidates and the informal vote for 1949 (House) was r = .38, and if the mean is reduced by r^2% (as in chapter 4, section 5a) it becomes 1.88% and the new estimate becomes 68%. These figures (87% and 68%) are simply two separate estimates of the deliberately informal vote. Thus in using the informal vote corrected for the number of candidates, then on 1949 figures, and allowing for Senate inflation of figures, between half and three quarters of this measure most probably represents deliberately informal voting.

b) geographical distributions

The number and shape of the metropolitan divisions varies between 1949 and 1966, but the approximate distributions for 1949 can be plotted on the maps for 1966, and these are given in figures 21 and 22. Figures 21a and 21b show the distribution of the deliberate and accidental informal votes in standard score form, and it is apparent from these that there is a great concentration of both in the city center. There is also some overlap of the patterns in the western and northern areas of the city.

The patterns independent of the overlap can be given by obtaining the residuals from their correlation, alternately subtracting the variance of the deliberate from the accidental vote and vice versa. These residual distributions are given in figures 22a and 22b, and it is apparent that the

distribution of the deliberate minus the accidental informal vote corresponds closely to the distribution of the informal vote (corrected for candidates) in 1966 (figure 9b).

The deliberate informal vote is geographically associated mostly with the city center and with low socio-economic status, and therefore largely with the ALP vote; the accidentally informal vote (independent of the deliberately informal vote) does not seem to be geographically associated with the extremes of any sociological factor, nor with party vote. Rydon (1963, page 180, footnote 21) quotes a study of voting in 1934 to the effect that deliberately informal votes varied from 27% to 66% of the total informal vote (N.B. uncorrected for candidates); perhaps the mapped distributions show more clearly the sociological and party correlates of this variation.

c) summary

These estimates are crude and obviously are only a first approximation based upon the only available data on this topic. The analysis has been made in order to get some idea of what the informal vote measure ($I\delta nC$) represents, and it seems likely that it is predominantly a measure of deliberately informal voting.

9. Within-division variability again

Given two areal scales of units, e.g. electoral divisions and subdivisions, then if the frequency distribution of a variable is highly skewed, e.g. an exponential curve towards the city center, and if the geographical patterning of subunits is appropriate, e.g. concentricity for the example given, then there is almost certain to be a correlation of within unit variability with the magnitude of the variables' averages for the larger units.

In this example the concentric patterning of subdivisions together with the exponential curve ensures an increasing within-division variability towards the city center, and this increase will correlate with the increasing magnitude of the variable.

There remains an unexplained difference between the two cities in that the pattern of within-division variability is more non-random for Sydney, and correspondingly explains more of the variance between some correlations for Sydney (table 21). Why this difference (if real) should exist is unknown. There are on average fewer electoral sub-divisions in Melbourne, and this could possibly cause the difference. The 'meaning' of within-division variability is also unknown. Even if it is a function of distribution shape then it still has an ecological significance (chapter 6, section 12b).

More research is needed on the scale variability of ecological effects, using more precise measures than those used in this thesis.

	Sydney		Melbourne	
	$r_{12} = .899$	$r_{45} = .794$	$r_{12} = .796$	$r_{45} = -.925$
	$r_{12.3} = .834$	$r_{45.6} = .729$	$r_{12.3} = .770$	$r_{45.6} = -.914$
% reduction	14%	16%	6%	7%

1 = %ALP
2 = SO$ II
3 = Within-div.var. (%ALP)
4 = % participation
5 = CC III
6 = Within-div.var. (%P)

Table 21. Partiallings of within-division variation

10. Combination regions

For the entire city then there is no correlation between participation and the ALP vote, but the informal vote correlates with both (table 13). Because each has a different geographical distribution (figures 9 and 10) then there will be different combination patterns of them in different parts of the city. Cox (1968) mentions some expectation that non-participation should vary with high Labour Party voting, but finds only a weak correlation between the two in London. Although voting is compulsory in Australia, any combination patterns involving participation may be reflected in part where voting is not compulsory.

The method of obtaining combination regions is very simple; the values of the (independent) sociological factors are used in the regional grouping method, giving regions which are combinations of various magnitudes of the factors used. The values of the voting variables are then obtained for each region and compared both to the values of the independent variables and to each other. This way there is obtained a socio-political regionalisation of the city which may be of help to any future research, and which may illuminate some of the controversies of research which are based upon inadequate consideration of the spatial sample.

Significance tests are not used to test the matching of the dependent and independent variables in the regions, because of spatial dependency and because of the small numbers used. However a similar research design in a pilot study (Herbert, G, 1969) did give highly significant results in the discrimination of similar categories of dependent variables by independent variables for Sydney.

a) choice of regions

The three voting variables are predicted most precisely by socio-economic status and city centrality from the three factor solution, but socio-economic status and life-cycle stage from the two factor solution is also an adequate predictor (table 13). The latter pair were chosen as the independent variables to be used in classification for two reasons. The first is that for Sydney they give more evenly numbered grouping (below), and secondly they allow a better comparison between cities because of the more similar factor structure between cities for the two factor solutions. The slight loss of precision in using life-cycle stage (two factor) as against city centrality is compensated for by these reasons. The derived regions are not 'right or wrong', only more or less appropriate (above some basic level) in the synoptic description of city patterns.

In Melbourne the heirarchical grouping of socio-economic status and city centrality (three factor) was identical to that based upon the two factor solution, but in Sydney it differed. Figures 23a and 23b give the heirarchical increase

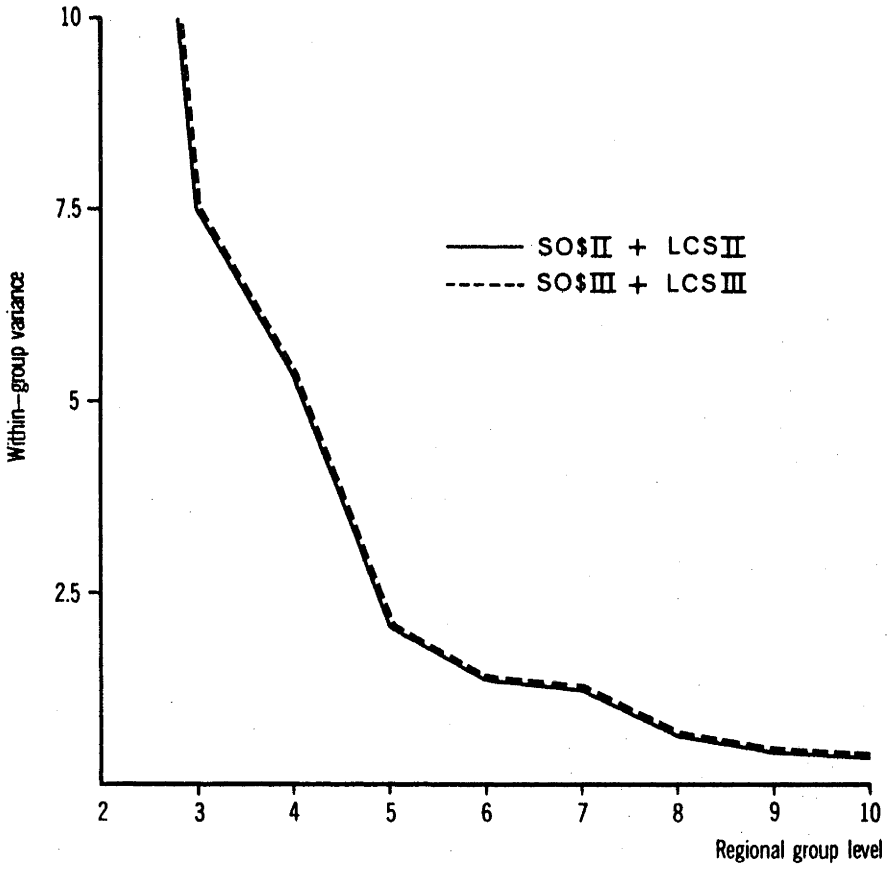

Fig. 23a. Melbourne: Heirarchical variance increase

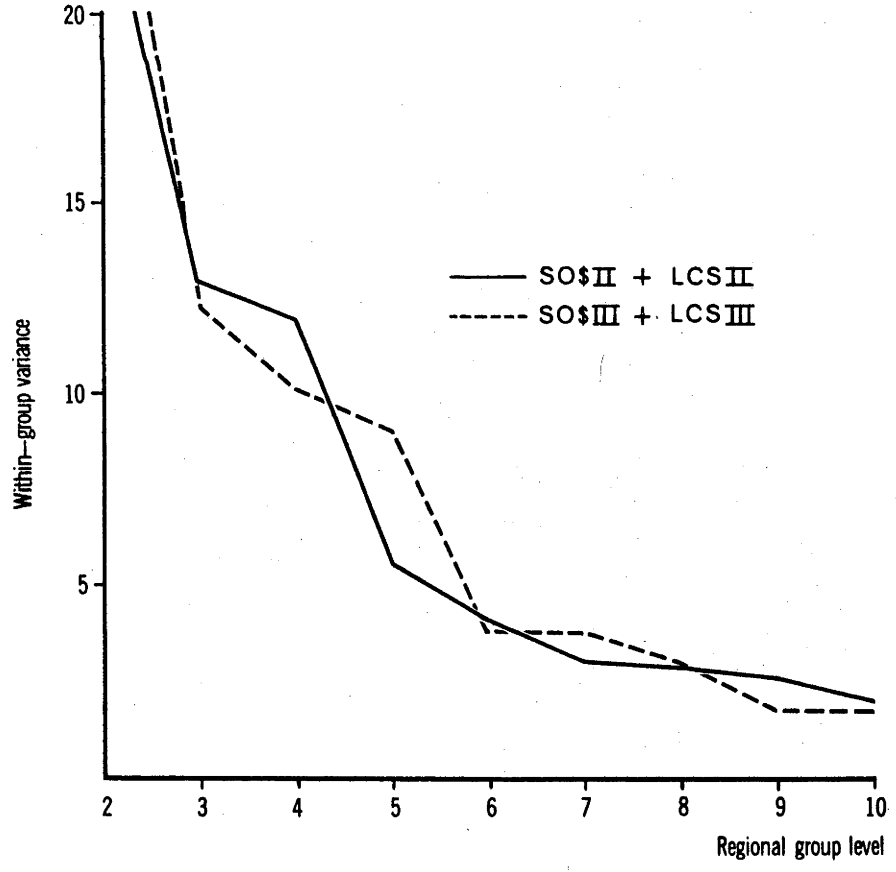

Fig. 23b. Sydney: Heirarchical variance increase

in variance upon group fusion (the mean within-group variance increase) for both classifications for both cities. Steps in the curves are located at group levels 3 and 5 for the two factor solution classifications, and these steps are used to select the levels used to study. If the criteria for selection are (i) minimum within-group variance, (ii) a high level of generality, then levels 3 and 5 are selected because they are at a high level of generality, and because the within-group variance increases sharply at the next respective levels.

The composition of these regional groups are as follows:

Sydney		Melbourne	
1	= ADLOTY	1	= ADKN
2	= BHJMQU	2	= GM
3	= CENPRV	3	= BEIQU
4	= FGIWZ	4	= RSTV
5	= KSX	5	= CFHJLP

For the three group level in Sydney, 1 unites with 2, and 4 unites with 5, and for Melbourne 1 unites with 2, and 3 unites with 4. The classification of socio-economic status and city centrality (three factor) for Sydney at the six group level is:

1 = ABDHJLMQU
2 = CENPRV
3 = FIW
4 = GKS
5 = OTY
6 = X

It was not used because of the reasons mentioned above.

b) region types

Tables 22a-c give the means and standard deviations for the three voting variables and the two social factors for each region for each city; all values are given in standard scores, therefore the standard deviations are directly comparable measures of within region variability.

Melbourne		Five Regions				
		1	2	3	4	5
%ALP	$\bar{x}$	-1.251	-.786	.828	1.217	-.509
	S	.091	.444	.735	.257	.350
%P	$\bar{x}$	.298	-1.892	.628	-1.195	.681
	S	.579	.267	.367	.632	.156
IδnC	$\bar{x}$	-.980	.537	.446	1.160	-.966
	S	.394	.706	.645	.588	.121
SO$ II	$\bar{x}$	1.612	1.084	-.647	-.746	-.160
	S	.184	.298	.522	.476	.386
LCS II	$\bar{x}$	-.242	1.585	.031	1.295	-1.174
	S	.283	.218	.274	.313	.355

Table 22a. Regional combinations of values, Melbourne five groups

Sydney		Five Regions				
		1	2	3	4	5
%ALP	$\bar{x}$	.528	-.097	-1.262	1.258	-.443
	S	.575	.406	.415	.270	1.114
%P	$\bar{x}$	.552	.680	-.086	-1.123	-.816
	S	.415	.755	.552	1.023	.821
IδnC	$\bar{x}$	.391	-.803	-.735	1.454	-.143
	S	.614	.619	.512	.485	.330
SO$ II	$\bar{x}$	.716	-.352	-1.027	1.221	-.709
	S	.507	.255	.682	.459	1.029
LCS II	$\bar{x}$	-.969	-.178	-.247	1.025	1.080
	S	.487	.871	.790	.745	.600

Table 22b. Regional combinations of values, Sydney five groups

		Three Regions					
		Melbourne			Sydney		
		1	2	3	1	2	3
%ALP	$\bar{x}$	-1.096	.148	-.509	.215	-1.262	.620
	S	.319	.562	.350	.576	.415	1.091
%P	$\bar{x}$	-.432	-.148	.681	.616	-.086	-1.008
	S	1.222	1.012	.156	.585	.552	.903
IδnC	$\bar{x}$	-.474	.814	-.966	-.206	-.735	.855
	S	.898	.672	.121	.857	.512	.922
SO$ II	$\bar{x}$	1.436	-.763	-.160	.182	-1.027	.419
	S	.335	.510	.386	.676	.682	1.192
LCS II	$\bar{x}$	.367	.484	-1.174	-.573	-.247	1.046
	S	.974	.760	.355	.790	.790	.649

Table 22c. Regional combinations of values, three groups for both cities

The first observation is that the mean values of the ALP standard scores are similar to those of socio-economic status, and likewise participation is similar to life-cycle stage. As expected the informal vote varies between these. The trends of the means are graphed for the five region level for easier comparison in figures 24a and 24b (with the signs reversed where appropriate for comparison).

The second observation is that there are regions of high ALP vote and low participation, and regions of low ALP vote and low participation, (and vice versa), for each city.

In Sydney the outer western suburbs (group 1) are of medium-high ALP vote with medium-high participation, contrasting with the central city (group 4) is of high ALP vote and low participation. Both have a high informal vote. On the other hand the northern suburbs (group 3) are of low ALP vote and medium-high participation, contrasting with the eastern suburbs (group 5) of medium-low ALP vote and low participation. In particular X (Wentworth) has a very low ALP vote (-1.647) and very low participation (-1.762).

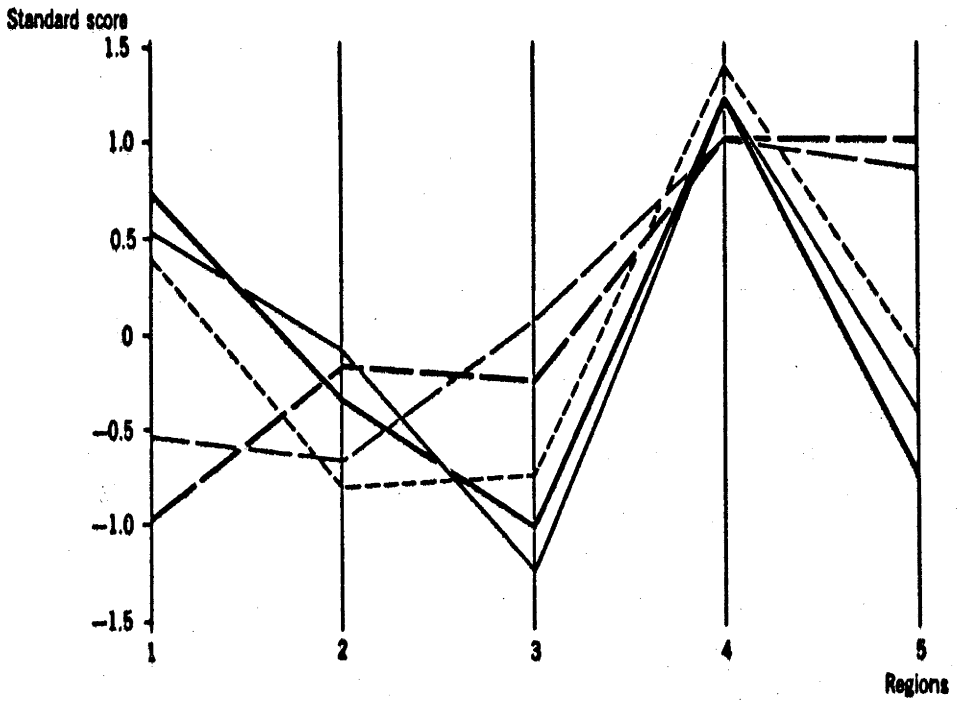

Fig. 24a. Sydney: Graph of regional mean values

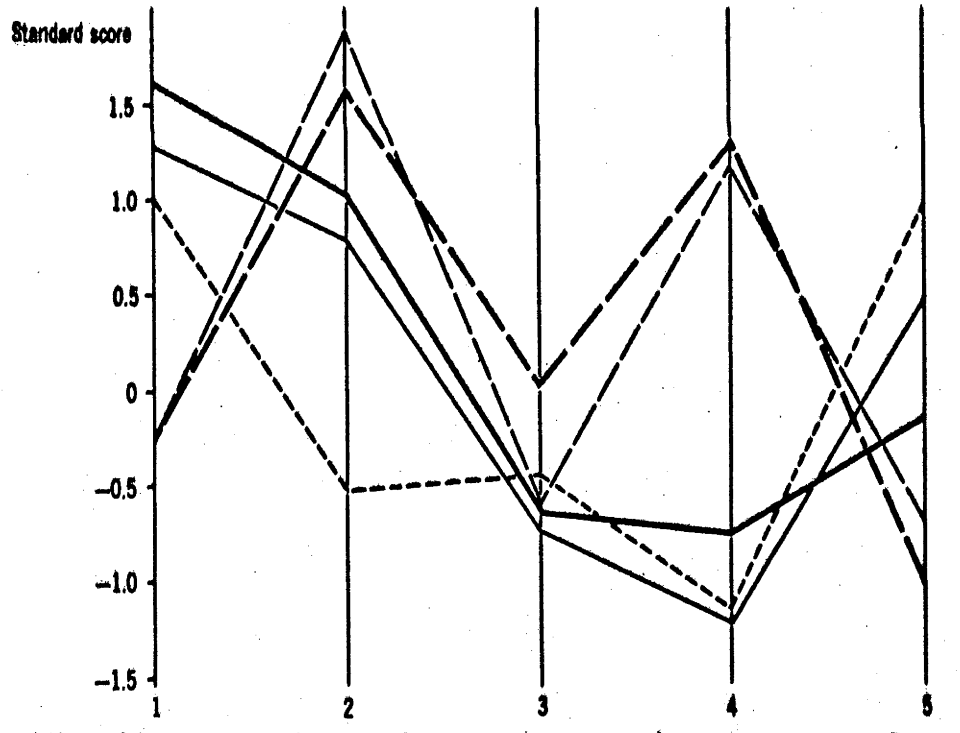

Fig. 24b. Melbourne: Graph of regional mean values

Socio–economic status (two factor)
% ALP vote
Life–cycle stage (two factor)
Participation
Informal vote minus candidates

The northern suburbs have a low informal vote but there is an average informal vote for the eastern suburbs.

In Melbourne the outer northwestern suburbs (group 3) have a high ALP vote and a medium-high participation, in contrast to the central city (group 4) which has a high ALP vote and low participation. They have a medium-high and a high informal vote respectively. On the other hand the outer eastern suburbs (group 5) have a medium-low ALP vote and a medium-high participation, contrasting to the inner southeastern suburbs (group 2) which have a low ALP vote and low participation. They have a low and a medium-high informal vote respectively.

The values for the three region level for each city are given in table 22c, but the level of generality is probably too high for fruitful consideration.

c) summary

It is apparent from these combination patterns that there is no simple association between voting behaviours which applies to all parts of the city (this applies of course to social factors also). The correlation between the ALP vote and participation, which is zero for the whole city, becomes positive in some regions of the city and negative in others, and this variation holds for both cities. Because of the overlapping of the single variable concentric and sectoral patterns (both voting and social) then two opposite patterns of combination are derived which exist together in the one city (i.e. for both Sydney and Melbourne).

11. Q Factor analysis

The regional grouping method gives discrete regions for which mean values are compared, but it is possible to have a single continuous city pattern which represents combinations of voting variables, and which therefore could be used in correlation for the whole city, and which could be mapped using form-lines.

One way to do this is to perform a 'Q' factor analysis in which all variables are firstly standardised, and then the data matrix is transposed to obtain factors of electoral divisions (as against factors of variables for the 'R' factor analysis). In the Q factor analysis each electoral division then loads upon each factor; because the factors are obtained over variables, and because we know from the R factor analysis what sociological factors these variables represent, then each Q factor will be a combination of different magnitudes of the R factors. The loading of an electoral division upon a Q factor then represents its correlation with that combination pattern, and the square of its loading is the amount of variance for that division which is associated with that combination pattern. However the loadings, rather than the squared loadings, have been used both in mapping and in correlation. They were used in the latter case because some loadings distributions are slightly U-shaped, and taking the square of the loadings would only emphasise this shape.

The maps of the Q factors used (from the two factor solution) are given in figures 25 and 26, and it is apparent that for both cities the first Q factor is a combination of high socio-economic status, outer-city life-cycle stage, and low city centrality, whilst the second Q factor is a combination of low socio-economic status, outer-city life-cycle stage, and average city centrality.

For Sydney there was practically no difference between the rotated and unrotated Q factors, but there was a considerable difference between the rotated and unrotated Q factors for Melbourne (corresponding to the magnitude of the R factors rotation difference there; appendix H). Why there should be this difference between cities is not known, but the unrotated factors for Melbourne gave the required combinations. The rotated factors were used for Sydney (inadvertently), though a comparison of the loadings in appendix H shows that the results of any correlations should be almost identical for both rotated and unrotated factors in Sydney.

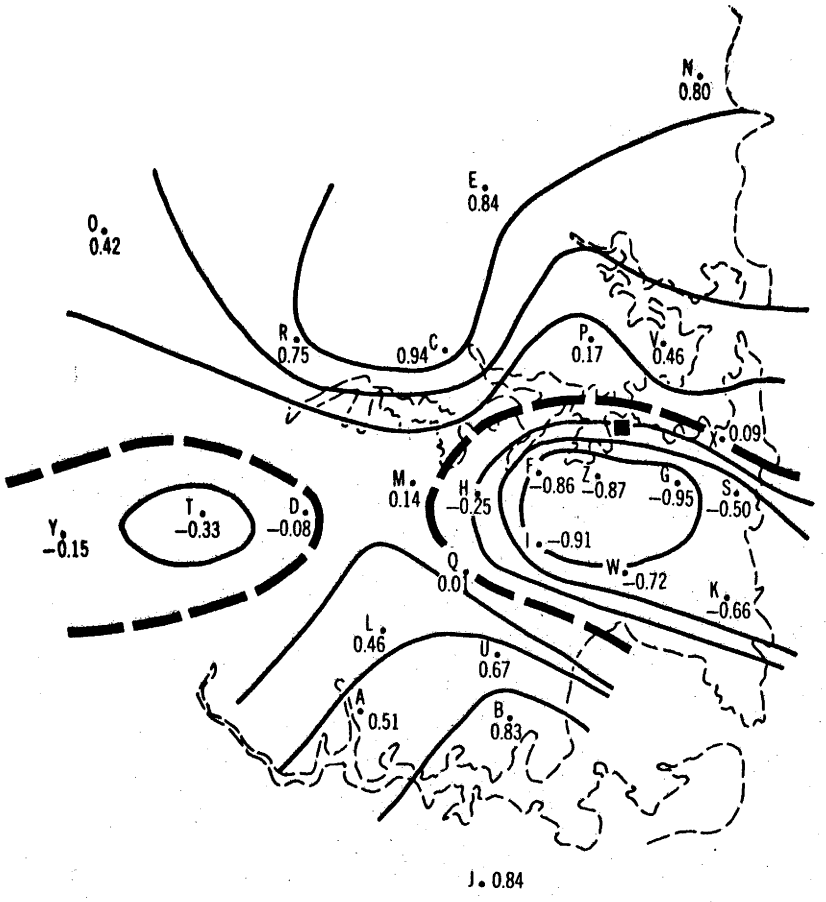

Fig. 25a. First varimax Q factor

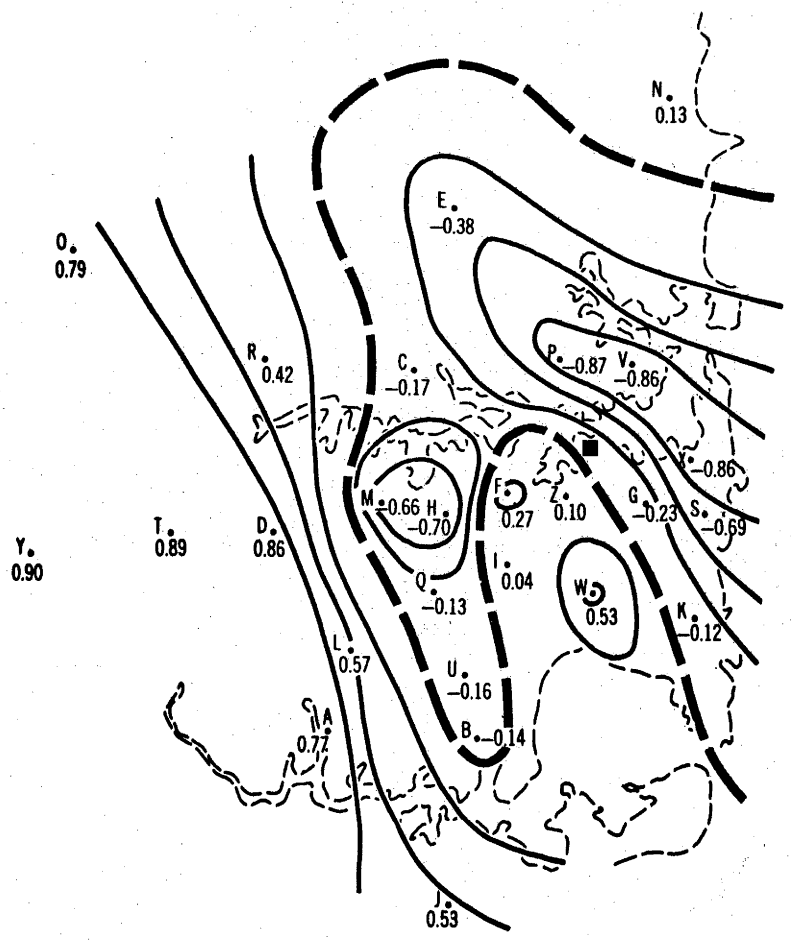

Fig. 25b. Second varimax Q factor

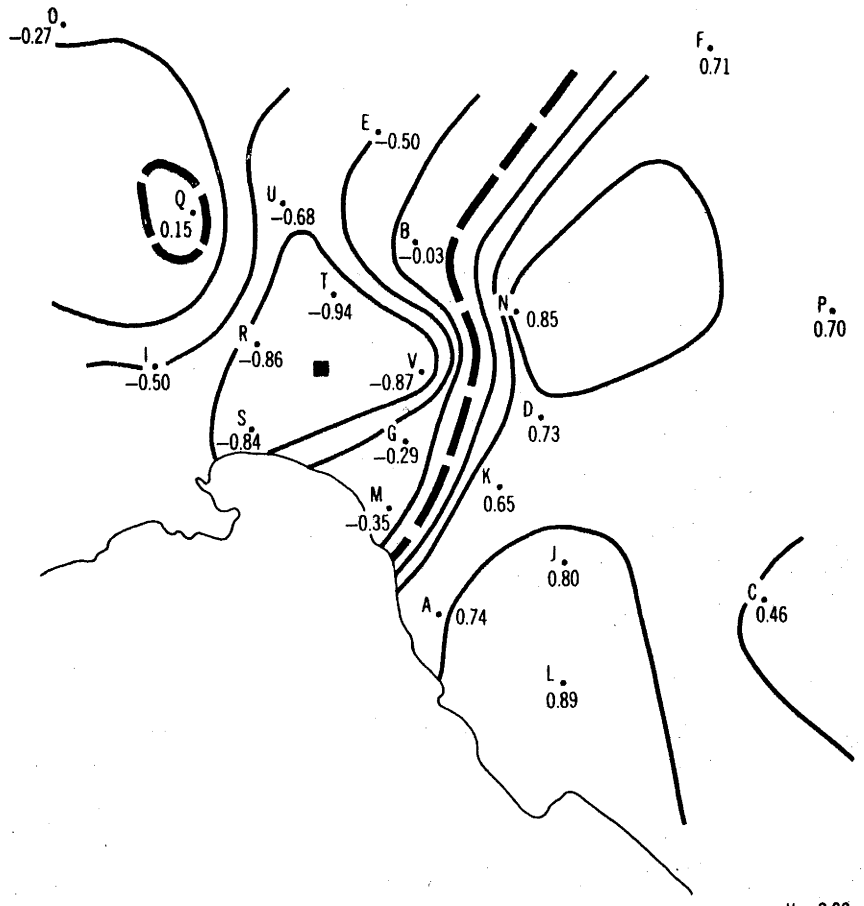

Fig. 26a. First components Q factor

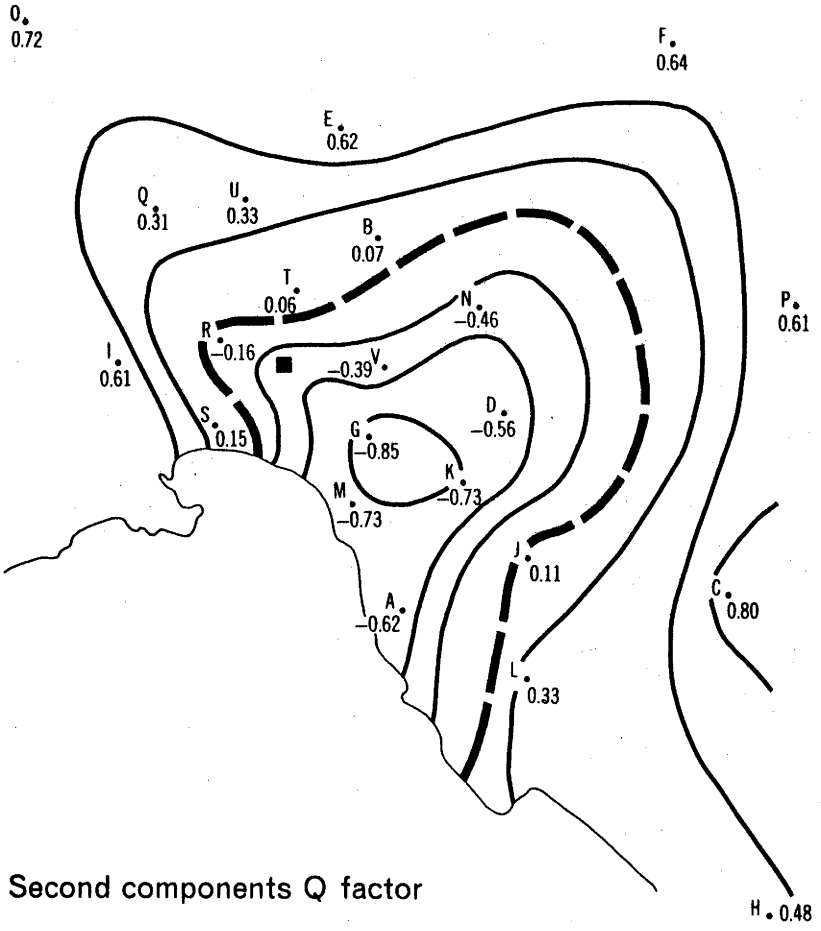

Fig. 26b. Second components Q factor

SYDNEY

Factor	%ALP	%P	I∫nC
Q1	-.6394	.6146	-.7956
Q2	.6003	.4035	.2751

MELBOURNE

Q1	-.8687	.6007	-.9318
Q2	.3923	.5759	.0478

Table 23. Correlations between Q factors and voting variables

The correlations between the Q loadings and the three voting variables are given in table 23, and it is clear that for both cities the first Q pattern predicts a combination of a low ALP vote, high participation, and a low informal vote. The second Q pattern predicts a combination of high ALP vote and high participation, but does not predict the informal vote at all.

The results given by the regional classification comparison method are clearly supported here. The reason for performing a Q factor analysis and correlation is firstly to see if similar results on city regionality are obtained using a different method, and secondly to display the results in a different format. Unlike the results from the Q factor analysis, the regional classes cannot be mapped as continuous distributions.

CHAPTER VIII

CONSIDERATIONS

What is the value of a study of the morphological relations of static patterns, one which uses aggregate data at a macro-scale, and is logically non-inferential because of the spatial dependency of geographic series?

Allardt (1969) discusses different scientific criteria, and considers that there are occasions when it is more appropriate to stress in a study its fruitfulness rather than to stress the logical safety and probability of its evidence. This thesis has stressed fruitfulness, and consideration of this is given below.

a) considerations

Non-experimental research cannot logically infer the mechanisms of the cause and effect process, and this is so whether the research uses individual or aggregate data, or whether it is morphological or 'causal process' in focus. In order to causally link covariances in phenomena, the causal mechanisms must be specified precisely by the researcher, using his experience, and using theory and empirical findings. The nature of the data and research design alone cannot demonstrate causes, but can only logically generate hypotheses about causes. However in experimental research the ability to manipulate the temporal order of events does not require the specification of causal mechanisms, but it does allow a demonstration of causality (Allardt, 1969).

For the generation of hypotheses by non-experimental research then any methods are allowable, but, if one wishes the hypotheses to be productive then they should be of as high informative content as possible. Allardt (1969, p.47) draws upon Zetterberg and Popper in stressing that the information content of a statement depends upon its degree of specification and therefore its degree of falsifiability. The greater variety of events accounted for by a statement, the higher its information content. Allardt also draws

upon Heiskanen in noting that the degree of falsifiability increases among other things with a decreasing chance to manipulate operational definitions, and further notes that either 'cross-level' statements (e.g. individual/aggregate/global attribute) or statements linking different types of subject matter (e.g. behaviour/social characteristics/land characteristics) have less chance than within-level statements of either containing tautologies or of giving variable results because of a manipulation of the operational definitions involved. There are usually more potential falsifiers when using statements which either cross types of measurement unit levels, or which involve different types of subject matter.

There is no cross-level analysis in this thesis, though there is a cross-scale inference that the city regionality of socio-economic status will influence the aggregate %ALP vote in electoral divisions. There are two scale effects considered, the first being the effect upon the electoral division averages, and the second being the effect upon within-division variability, differing by status region type.

Mainly two different types of subject matter are involved in both cases - voting behaviour and social characteristics (there are also the linear distance measures of regional geographic distance and distance from the CBD) - and a range of potential falsifiers have been examined, including extraneous voting variables, some weaknesses of method such as sampling, and the contrasting of the partialling of the variety of sociological factors extracted by the two and three factor solutions.

The result of the regional contagion analysis, for the set of variables analysed, has a high degree of probability in that correlations are high, but this is not the same as having a high information content. The scale of the analysis, whether this be spatial or in terms of other detail, is still fairly high. The results are a first approximation, giving some information on regional contagion where there was none before.

There is an obvious need for spatial scale analysis in order to give extra information content to statements, plus a need for a better identification of hypothesised causal variables. Relations between these variables should be specified at different areal scales, and relations between scales, as a form of ecological effect, should also be specified. Relationships at a higher spatial scale or a greater degree of generality are still useful. Obviously more and more phenomena are connected at higher degrees of generality (this is sometimes equivalent to the relations between macro-scale averages for geographic patterns) and the creative scientist often finds it fruitful to vary his thinking along scales of generality in order to connect diverse phenomena; he would then usually test his concepts against real world detail or logical algorithms, but this latter stage of productive analysis is not open to this thesis with its restricted data and time.

An example of the limitations of the methods of this thesis for the investigation of potential falsifiers is given in the analysis of the relations between the ALP residual, regional contagion, and life-cycle stage. The analysis can sort the relative degrees of aggregate causality in terms of variance accounted for but cannot delineate any causal process involving the relations between the individual level and aggregate level data.

There might be a spatial correlation between the patterns of life-cycle stage and the residual, and in partialling regional contagion we are finding the degree to which the aggregate pattern of regional contagion rather than the aggregate pattern of life-cycle stage accounts for the statistical variance of the aggregate ALP residual. This then indicates the postulated ecological effect.

The principal finding of the thesis is the type A effect, postulated to be generated by regional social contagion. If so, then its form is opposite to that which could be generalised from Segal and Meyer (1969, p.223), which would give an increase of the Liberal Party residual with an increase in socio-economic status, and an increase

in the ALP residual with a decrease in status. Although they do not specify regions it is clear that their model would produce type B rather than type A relations if generalised to within-region influence.

Differences between the two studies are firstly that their inferences are concerned with small group dominance by the Republican Party (in terms of numbers) and not with spatial aggregates. Secondly, in terms of numbers they equate high status exactly with the Republican Party, and are not concerned with a continuous gradient of status nor with the numerical distribution of individuals along the gradient. Their model might be appropriate for small groups, within limiting assumptions, but might be inadequate for spatial aggregates. If this is so then one cannot generalise the type B relations to spatial aggregates. Alternatively, if their model forms part of a regional process, then the type A relations of the aggregate data could be a reflection of additional influences operating.

Some of these other influences include the effects of groups and organisations of varying formality, numerical size, and areal extent, the perception of and conforming to community norms and values, and the interaction between the state of the local socio-political consensus with the regional concensus. Either as an alternative to the hypothesised contagion influence or in conjunction with it then there may be the selective migration into a region of people with socio-political values which are similar to the region, but with the people being at a different socio-economic level (or a migration of young people from the inner to the outer areas of the region). There might also be a general migration of younger people to the regional peripheries where, according to the contagion and immunization hypotheses, they in particular will be influenced by the region. Because the effects of these processes are unknown (with any degree of reliability) then their relative importance for the high and low status regions is unknown; one would expect differences between regions because some of the processes make theoretical

sense for one region but not for the other (e.g. one would not expect a young person on the periphery of a low status inner city region to move towards the center of it as he ages, whereas the move is plausible for a high status region).

b) a further example for consideration

Age variables usually correlate highly with life-cycle stage, though for Cox's (1968) four factor solution 'age' emerged separately as the fourth factor. For Sydney and Melbourne the two age variables load mainly upon life-cycle stage in the three factor solution (though old age loads substantially on socio-economic status in the two factor solution). Many political observers have assumed that the theory of political 'senescence' accounts for the correlation between age (or life-cycle stage) and party vote. This theory assumes that people generally change from radical politics in their youth to conservative politics in their old age. Butler and Stokes (1969, p.55-61) give evidence that rather than political conservatism increasing with age, there is an increase in the conservation of established political preferences, supporting the immunization theory of McPhee and Ferguson (1962). The most important period of an electors life (apart from childhood) in terms of influencing his vote is the early period of political decisions and voting, and for each generation, then at this period there will be typical (global level) social and political influences, common to that generation, shaping the individuals choice in some way, and giving rise to 'political generations' (Butler and Stokes, 1969). Thus there are likely to be age bands in which there will be an excess of electors voting either for one or the other party. If the residual of the correlation of party vote with socio-economic status could be plotted over age groups then one would expect a cyclic wave form as different generations voted pro-Labour or pro-Conservative (in Britain). It happens that right now more elderly people vote for the Conservative Party in Britain because of the social and political conditions existing in their youth (Butler and Stokes,1969). The

probable causality of this is brought out by comparing cross-sectional to longitudinal data (though there are weaknesses in using recall data here). Crosssection method here compares age groupings of different individuals, whereas longitudinal method compares change over time for the same individuals. The 'senescence' theory has confounded cross-section data with longitudinal process, incurring the crosssectional fallacy (Alker, 1969).

From this information we can infer firstly that there is unlikely to be any individual level causal process between age (or life-cycle stage) and party vote, and secondly that there can be an ecological causal correlation in that if more elderly people now vote Conservatively, then areas where there are more elderly people will produce a more Conservative aggregate vote (i.e. after socio-economic status has been accounted for).

There may even be an ecological effect in that each age generation might form a loose subculture of contacts, influencing behaviour within the generation in a manner similar to the influencing within religious or ethnic subcultures. This would be a form of group-anchoring which preserves established preferences.

Other causes of an aggregate correlation between age and party vote are firstly that it may take time to accede to a large income and therefore to be able to afford to live in a high status area, and secondly that the aged rich tend to live longer than the aged poor. They may even collect in old people homes in the high status suburbs. In both cases the aggregate correlation describes a relation between variables which is different to that in the individual level causal process.

This example gives some idea of the way in which individual processes may be related to aggregate patterns, and stresses the need in research for individual processes to be explicitly related to aggregate patterns.

c) summary

The initial hypothesis about the deviation-amplification of social characteristics to give an amplified pattern of voting behaviour has been supported by this study, but in the form of descriptive aggregate patterns only.

In addition distinctive subregions for combinations of voting variables exist but again these are for aggregate patterns. The aggregate correlation between high status and low participation near the inner city for example need not mean that individuals of high status tend to have low participation, but might reflect the mixture of social types in that area.

This thesis has produced descriptive information about voting behaviour in two Australian cities for the 1966 Federal election and has introduced the concept of regional contagion of the party vote. The method used to obtain the region contagion measure is deductive, but can be used in any situation where a measure of regional contagion is required.

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APPENDIX A

CENSUS VARIABLES

NO.	NAME	DESCRIPTION
1.	Population density	population size divided by land area.
2.	Youth	persons under 15 yrs as a proportion of the total population.
3.	Age	persons between 70 and 74 yrs as a proportion of persons over 15 yrs.
4.	Singularity	number of persons not married and over 15 yrs as a proportion of the total population (should be of persons 15+, but the error is not serious).
5.	Female employment	number of employed females as a proportion of the number of females over 15 yrs.
6.	Australian born	number of Australian born as a proportion of the total population.
7.	Males unemployed	number of unemployed males divided by the number of employees plus number of employers plus number of self-employed (all male).
8.	Owner occupied house	number of owner occupied houses as a proportion of the total number of houses.
9.	Adults per dwelling	number of persons over 15 yrs divided by the number of houses plus number of flats.
10.	House without a car	number of houses without a car as a proportion of the total number of houses.
11.	Education	number of persons with the Leaving Certificate or equivalent as a proportion of the number of persons over 15 yrs.
12.	Male Occupation	males in professional or executive occupations (census classes 0 and 1) as a proportion of males over 15 yrs.

APPENDIX A (continued)

NO.	NAME	DESCRIPTION
13.	Male employees	number of male employees divided by the number of employers plus the number of self-employed (all male).
14.	Rooms per house	total number of rooms divided by the total number of houses.
15.	Single masculinity	number of unmarried males over 15 yrs divided by the number of unmarried females over 15 yrs.
16.	Roman Catholic	number of persons describing themselves as Roman Catholic on the census form as a proportion of the total population.
17.	Owner occupied flat	number of owner occupied flats as a proportion of the total number of flats.

APPENDIX B

INTERCORRELATION MATRICES

Sydney above the diagonal and Melbourne below the diagonal

Var.No.	1	2	3	4	5	6	7	8	9	10
1		-.7764	.5577	.7391	.7728	-.5301	.4589	-.3560	.4021	.6117
2	-.7884		-.8457	-.8959	-.7853	.5902	-.4491	.3297	-.2447	-.5043
3	.4671	-.7580		.7345	.4112	-.3084	.1645	-.0647	.0411	.1767
4	.7268	-.9194	.5880		.8150	-.6829	.6259	-.5751	.4754	.5214
5	.6942	-.6471	.0697	.7619		-.7751	.6945	-.6040	.4296	.7036
6	-.6263	.4187	.0985	-.5306	-.7978		-.7949	.6691	-.4467	-.6483
7	.5338	-.4974	.0417	.6248	.7911	-.8402		-.8676	.6756	.7203
8	-.5518	.5362	-.0605	-.7031	-.8415	.7260	-.9225		-.8245	-.7395
9	.3320	-.2465	-.1303	.4576	.5406	-.5844	.6164	-.6547		.7236
10	.6995	-.6594	.2708	.7476	.8153	-.8187	.8559	-.8430	.6934	
11	.2083	-.4782	.5601	.4174	.0429	.1993	-.1586	.0937	-.5031	-.1767
12	-.0531	-.1569	.4230	.0651	-.3079	.5413	-.5669	.4648	-.6646	-.5251
13	.1911	-.0364	-.2891	.1188	.3823	-.4624	.3949	-.4463	.7243	.5785
14	.2787	-.4828	.6363	.3561	-.0414	.3022	-.3674	.2542	-.4434	-.1652
15	-.1522	.3948	-.5166	-.4494	-.0989	-.2598	.1474	-.0135	.2708	.0817
16	.2941	-.0860	-.3778	.2758	.6351	-.7570	.7227	-.7102	.7482	.6640
17	-.0765	-.0819	.4775	-.0333	-.4382	.5388	-.6772	.6669	-.5413	-.4898

APPENDIX B (continued)

INTER CORRELATION MATRICES

Sydney above the diagonal and Melbourne below the diagonal

Var.No.	11	12	13	14	15	16	17
1	.1440	-.2033	.2521	.1501	-.1443	.2865	-.1383
2	-.5043	-.1441	.1009	-.3617	.3660	-.0388	-.0810
3	.6485	.4515	-.3334	.5049	-.5626	-.2480	.3841
4	.5455	.0942	.0364	,2684	-.2540	.1831	-.1092
5	.2286	-.2617	.2460	.0357	-.0528	.4037	-.4097
6	-.2530	.2962	-.2510	.0263	-.0856	-.5852	.4327
7	.0057	-.4796	.5106	-.3355	.3854	.6940	-.6590
8	.0172	.5121	-.6236	.5388	-.4818	-.7169	.6534
9	-.2341	-.5996	.7735	-.5484	.5380	.7075	-.5536
10	-.3245	-.7387	.7048	-.5431	.4491	.7949	-.6407
11		.8095	-.7005	.7291	-.7377	-.5278	.4802
12	.8666		-.8937	.8183	-.8007	-.8618	.7480
13	-.7153	-.8150		-.7998	.7549	.7939	-.6743
14	.7184	.7186	-.4472		-.8556	-.7042	.6666
15	-.7869	-.7230	.5815	-.7108		.7646	-.6433
16	-.5606	-.7843	.6848	-.5124	.3977		-.8199
17	.6000	.7715	-.6155	.6713	-.5307	-.7972	

APPENDIX C

PRINCIPAL COMPONENTS FACTOR LOADINGS

	Sydney					Melbourne				
	Two Factor		Three Factor			Two Factor		Three Factor		
Var.No.	1	2	1	2	3	1	2	1	2	3
1	.4700	.6573	.4700	.6573	.4776	.5266	.6536	.5266	.6536	.1884
2	-.2699	-.9096	-.2699	-.9096	-.2170	-.3761	-.8754	-.3761	-.8754	-.1935
3	-.0737	.8719	-.0737	.8719	.2038	-.1332	.8035	-.1332	.8035	.4110
4	.4181	.8757	.4181	.8757	-.0479	.5176	.8211	.5176	.8211	.0252
5	.6198	.6640	.6198	.6640	.0481	.7920	.4439	.7920	.4439	-.2175
6	-.6488	-.5374	-.6488	-.5374	.2891	-.8612	-.1594	-.8612	-.1594	.1517
7	.8307	.3171	.8307	.3171	-.3212	.8929	.2154	.8929	.2154	-.2535
8	-.8627	-.1900	-.8627	-.1900	.3485	-.8721	-.2911	-.8721	-.2911	.2468
9	.8345	.0539	.8345	.0539	-.0165	.8172	-.0764	.8172	-.0764	.2135
10	.9134	.1918	.9134	.1918	.2406	.8892	.3578	.8892	.3578	.1460
11	-.4066	.7878	-.4066	.7878	-.4117	-.4571	.7929	-.4571	.7929	-.3113
12	-.8307	.4568	-.8307	.4568	-.2336	-.7693	.5523	-.7693	.5523	-.1907
13	.8391	-.3748	.8391	-.3748	.2123	.7296	-.3554	.7296	-.3554	.4391
14	-.6739	.6302	-.6739	.6302	.0007	-.4693	.7340	-.4698	.7340	.1840
15	.6646	-.6337	.6646	-.6337	-.0645	.3668	-.7427	.3668	-.7427	.2606
16	.9200	-.2085	.9200	-.2085	-.0505	.8885	-.2256	.8885	-.2256	-.1250
17	-.8088	.2629	-.8088	.2629	.2205	-.7685	.4141	-.7685	.4141	.2571

APPENDIX D

VARIMAX ROTATED FACTOR LOADINGS

	Sydney					Melbourne				
	Two Factor		Three Factor			Two Factor		Three Factor		
Var.No.	1	2	1	2	3	1	2	1	2	3
1	.0499	.8065	.1410	.9212	-.1117	.7967	.2641	.6960	-.0139	.6201
2	.2535	-.9143	.2447	-.9048	.2620	-.7903	-.5321	-.5439	-.1930	-.7824
3	-.5248	.7002	-.4808	.7569	-.0570	.3233	.7476	.0002	.2899	.8650
4	-.1099	.9642	-.2115	.7803	-.5389	.8798	.4098	.7128	.1885	.6317
5	.1733	.8916	.0929	.7371	-.5248	.9061	-.0558	.9120	-.0302	.1970
6	-.2650	-.7997	-.0655	-.4626	.7584	-.8103	.3325	-.8450	.2737	-.0350
7	.5361	.7094	.3142	.3353	-.8263	.8673	-.3026	.9325	-.1957	.0076
8	-.6307	-.6186	-.4008	-.2332	.8287	-.8907	.2277	-.9385	.1444	-.0671
9	.6789	.4882	.5775	.3038	-.5232	.6455	-.5069	.5776	-.6112	.1093
10	.6727	.6470	.6490	.5776	-.4173	.9413	-.1809	.8169	-.3545	.3835
11	-.7625	.4523	-.8991	.2428	-.2970	.0453	.9141	.0156	.8978	.3582
12	-.9465	-.0532	-.9574	-.0500	.1847	-.3475	.8810	-.3809	.8500	.2562
13	.9101	.1272	.9089	.1038	-.2295	.4207	-.6939	.3150	-.8654	.0561
14	-.9055	.1769	-.8571	.2637	.2171	.0027	.8715	-.2165	.5676	.6515
15	.8995	-.1848	.8293	-.3048	-.2584	-.0940	-.8230	-.0539	-.7893	-.3581
16	.8905	.3111	.7785	.1118	-.5232	.6247	-.6709	.7234	-.5297	-.2284
17	-.8252	-.2060	-.6668	.0603	.5689	-.4217	.7643	-.6099	.4951	.4593

APPENDIX E

VARIMAX ROTATED FACTOR SCORES

Sydney

	Two Factor		Three Factor		
	1	2	1	2	3
E.D.	SO$	LCS	SO$	LCS	CC
A	0.3241	-1.1660	0.7971	-0.4078	1.3441
B	-0.7539	-0.5289	-0.1170	0.4834	1.6699
C	-0.7600	-0.4659	-0.5260	-0.0764	0.8077
D	0.6836	-0.5189	0.9620	-0.0875	0.6325
E	-2.0152	-0.7528	-2.0406	-0.7298	0.6201
F	1.3107	0.5564	1.4988	0.8037	-0.0696
G	0.6771	1.5305	0.2397	0.7966	-1.6008
H	-0.3178	0.6575	-0.0196	1.1031	0.4474
I	1.0015	0.9234	1.0896	1.0115	-0.3494
J	-0.2032	-1.7170	-0.2219	-1.6893	0.6227
K	0.1279	0.4264	-0.0425	0.1482	-0.5353
L	0.1428	-0.5951	0.6888	0.2618	1.3260
M	-0.5278	0.5627	-0.3969	0.7574	0.1743
N	-0.5214	-1.0184	-0.7904	-1.3916	-0.0890
O	0.4932	-1.7711	-0.2726	-2.9067	-1.0549
P	-1.1158	0.8017	-1.1656	0.7221	-0.1720
Q	-0.0286	0.0437	0.4004	0.7040	0.8848
R	-0.1794	-0.7397	-0.1370	-0.6481	0.3919
S	-0.3980	1.2076	-0.6207	0.8354	-0.8221
T	1.2496	-0.6108	1.2273	-0.6507	-0.0739
U	-0.2803	-0.0845	0.1231	0.5450	0.9277
V	-1.5698	0.6925	-1.4613	0.8690	0.2880
W	1.1969	0.1254	1.1751	0.0649	-0.3286
X	-1.8577	1.6068	-2.4541	0.6748	-1.4560
Y	1.4005	-1.1532	0.9826	-1.7892	-0.7331
Z	1.9211	1.9878	1.0816	0.5963	-2.8523

APPENDIX E (continued)

VARIMAX ROTATED FACTOR SCORES

Melbourne

	Two Factor		Three Factor		
	1	2	1	2	3
E.D.	LCS	SO$	CC	SO$	LCS
A	-0.1919	1.3908	-0.3688	1.1621	0.7011
B	0.0480	-0.0852	-0.2080	-0.4723	0.4133
C	-1.2775	-0.7233	-0.5737	0.2891	-1.7323
D	-0.2326	1.5342	-1.0005	0.4187	1.7283
E	-0.0720	-1.2058	0.1790	-0.8655	-0.8307
F	-1.5760	-0.3544	-0.9690	0.5172	-1.5242
G	1.7394	1.2951	1.9620	1.7047	0.4800
H	-1.0365	-0.1535	-0.7824	0.2035	-0.7332
I	0.0355	-1.0573	-0.3412	-1.6558	0.2965
J	-0.5585	0.2774	-0.8888	-0.2232	0.5052
K	0.0714	1.7345	-0.2702	1.2736	1.1542
L	-1.1726	0.2698	-1.0754	0.4006	-0.3665
M	1.4313	0.8736	1.6539	1.2645	0.2662
N	-0.6152	1.7903	-0.8857	1.4241	0.8827
O	-0.4911	-1.4414	0.4485	-0.0792	-2.1657
P	-1.4226	-0.2761	-0.8575	0.5379	-1.3904
Q	-0.3071	-0.1180	-0.9684	-1.1240	0.9939
R	1.5434	-0.6267	1.7785	-0.2599	-0.2146
S	0.8581	-0.8535	0.4359	-1.4977	0.6434
T	1.4975	-1.3231	1.6061	-1.1688	-0.2401
U	0.4484	-0.7674	-0.1296	-1.6520	0.8308
V	1.2806	-0.1801	1.2552	-0.1976	0.3020

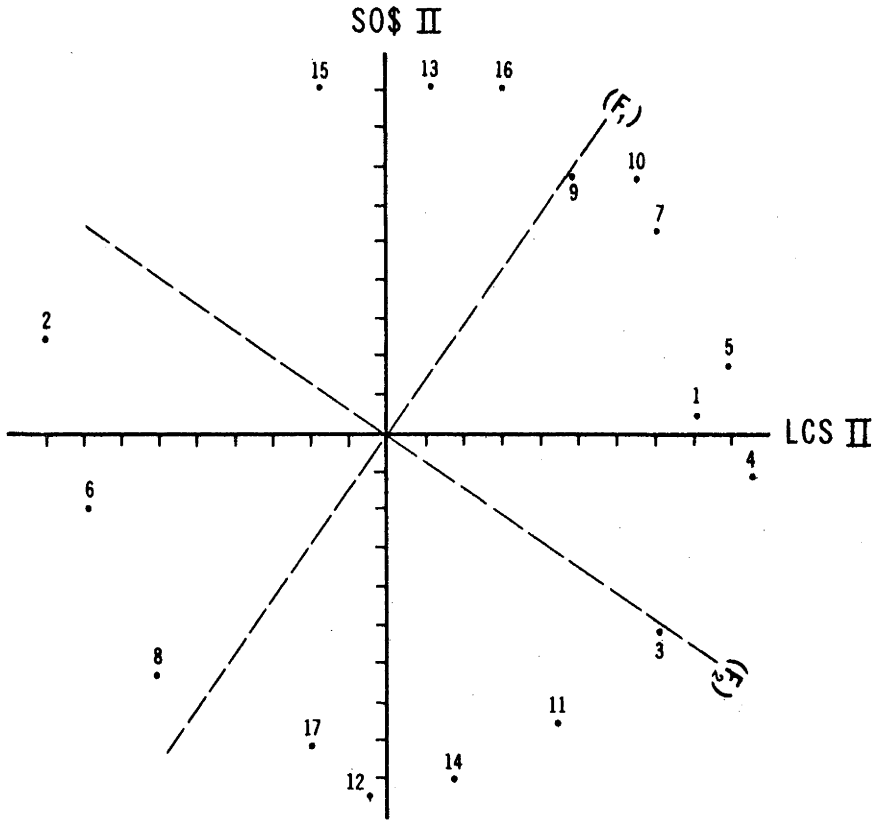
INDEX : E.D. = Electoral division
SO$ = socio-economic status
LCS = life-cycle stage
CC = city centrality

APPENDIX F

EIGENVALUES AND VARIANCE PERCENTAGES FOR FACTORS

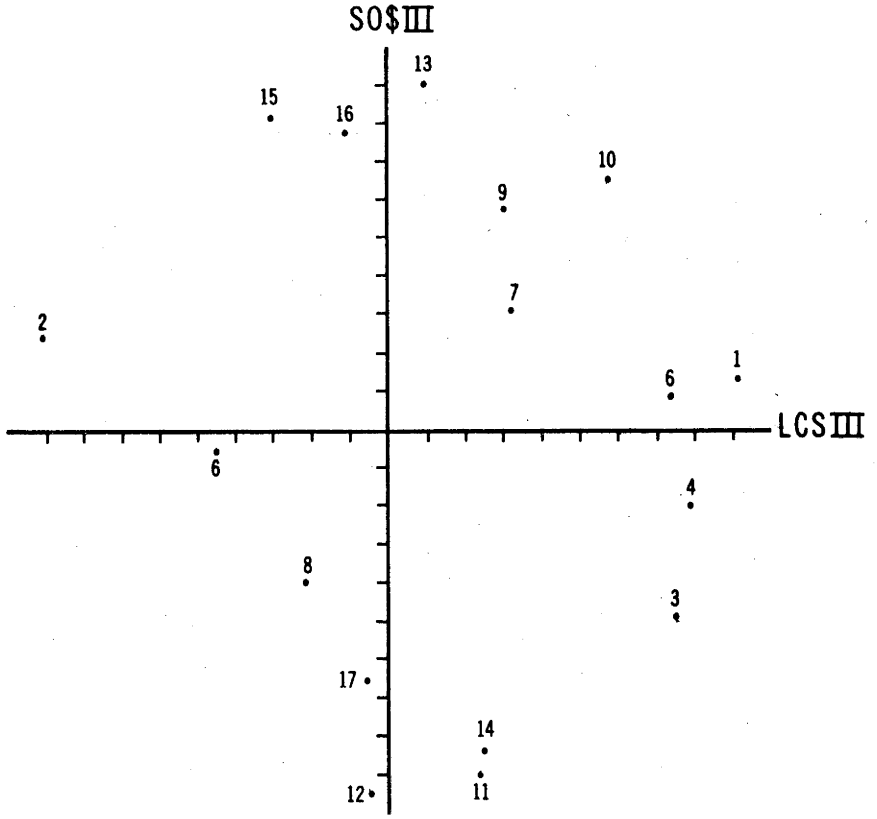
	Sydney					Melbourne				
	Two factor		Three factor			Two factor		Three factor		
R ANALYSIS	1	2	1	2	3	1	2	1	2	3
	SO$	LCS	SO$	LCS	CC	LCS	SO$	CC	SO$	LCS
Eigenvalue	8.20	5.57	8.20	5.57	1.01	8.16	5.37	8.16	5.37	1.01
% total variance: Principal axes	48.23	32.79	48.23	32.79	5.95	47.99	31.61	47.99	31.61	5.97
" " " Varimax	43.89	37.13	37.69	26.18	23.11	43.18	36.42	39.09	26.70	19.77
Q ANALYSIS	1	2	1	2	3	1	2	1	2	3
Eigenvalue	10.17	8.67	10.17	8.67	2.75	9.62	6.15	9.62	6.15	2.09
% total variance: Principal axes	39.11	33.36	39.11	33.36	10.56	43.73	27.97	43.73	27.97	9.50
" " " Varimax	39.11	33.36	38.76	32.95	11.32	36.02	35.69	35.47	35.61	10.13

APPENDIX G: AXES PLOTS OF FACTOR LOADINGS

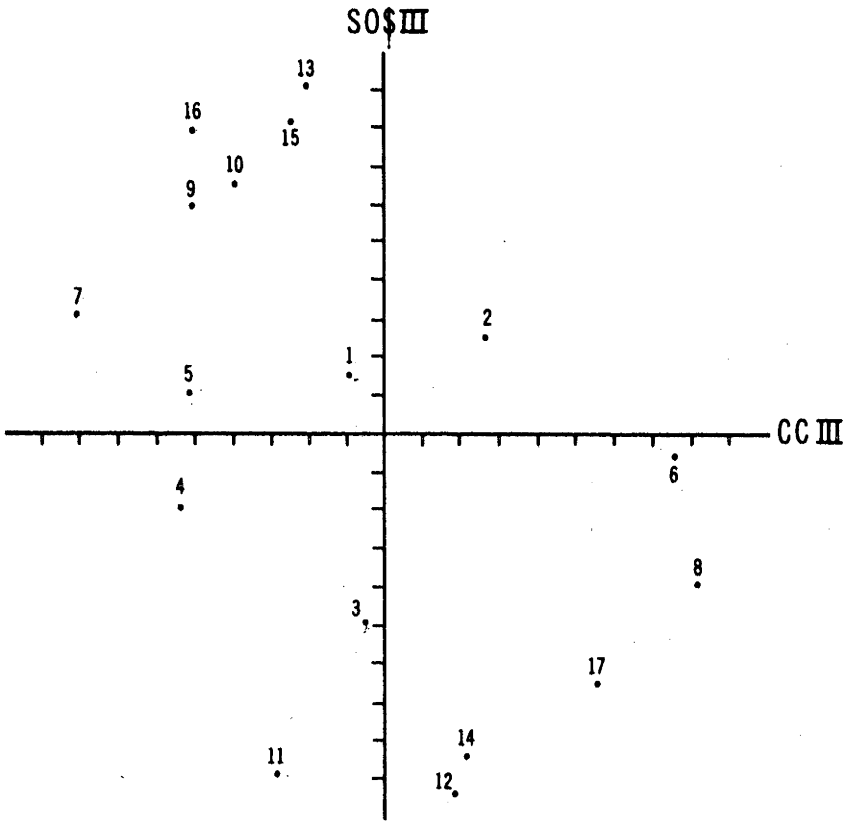


G. 1: Sydney, Two factor.

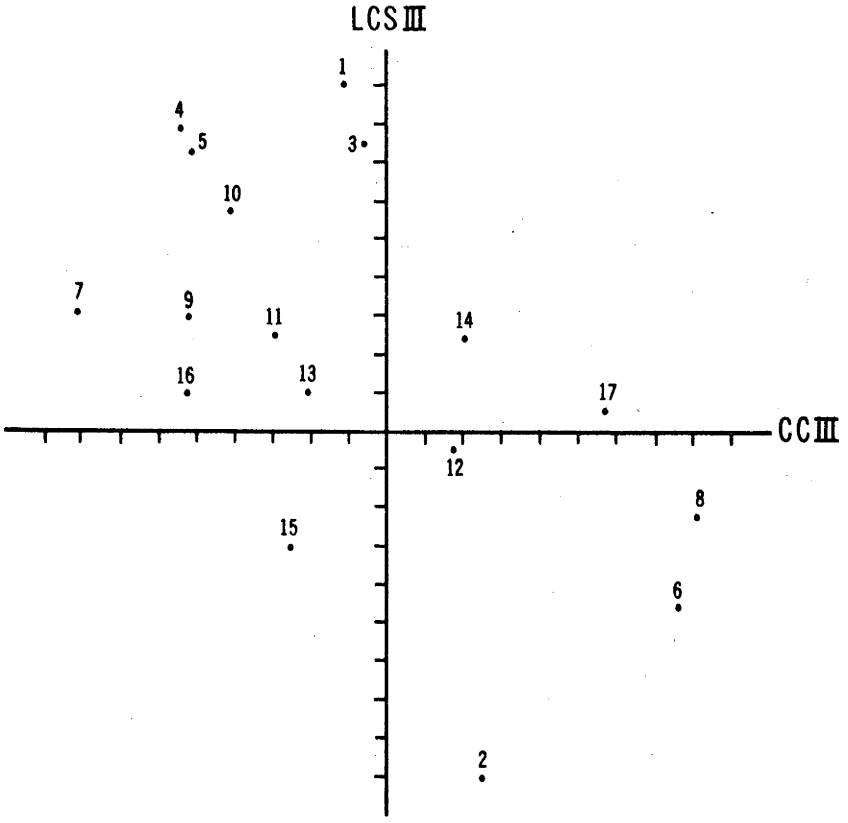
Broken diagonals show position of unrotated axes



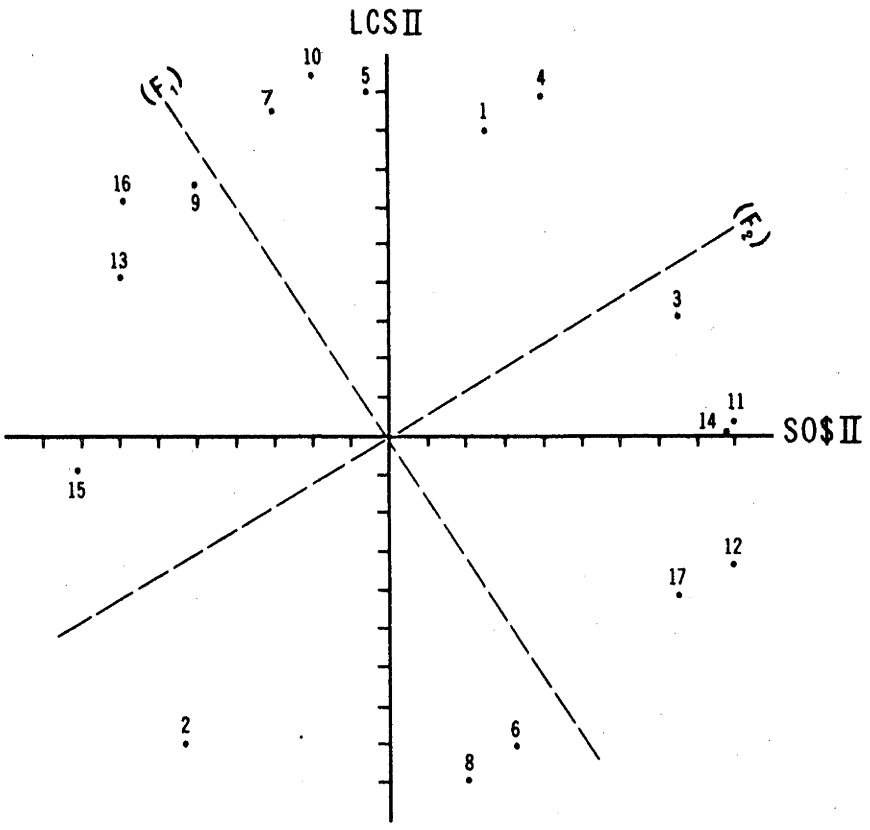
G. 2: Sydney, three factor



G. 3: Sydney, three factor

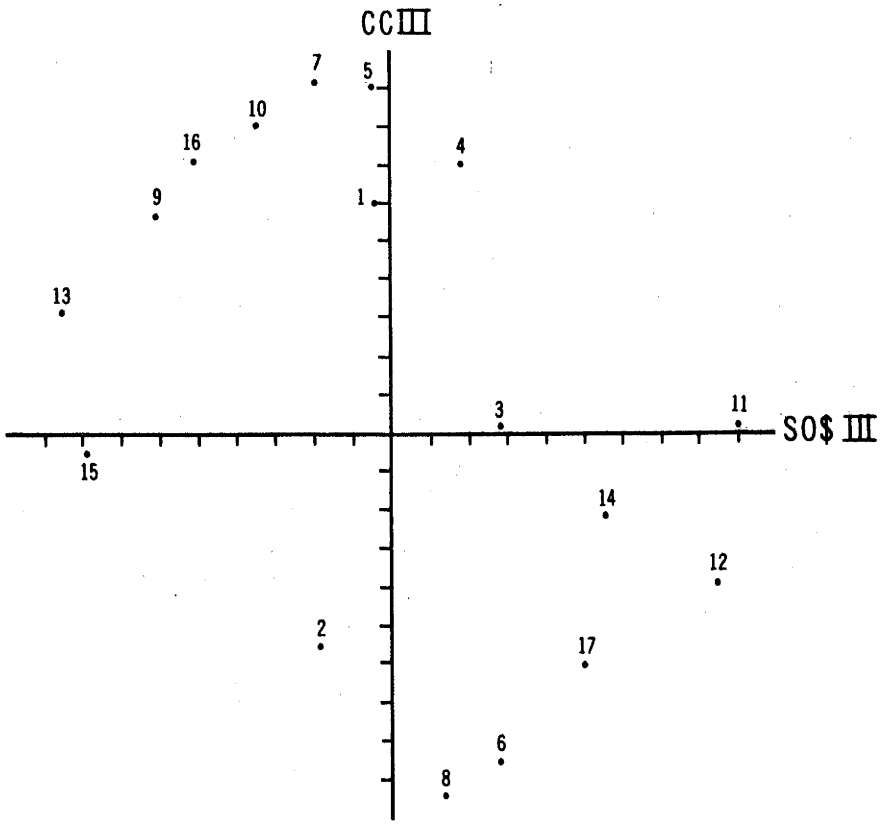


G. 4: Sydney, three factor

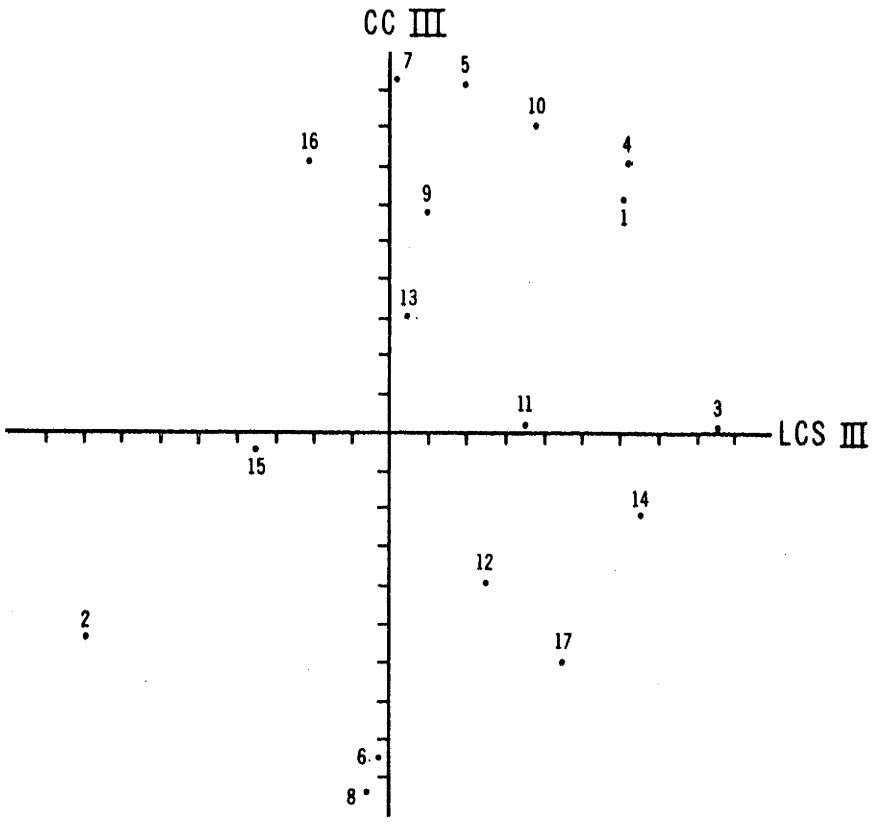


G. 5: Melbourne, Two factor.

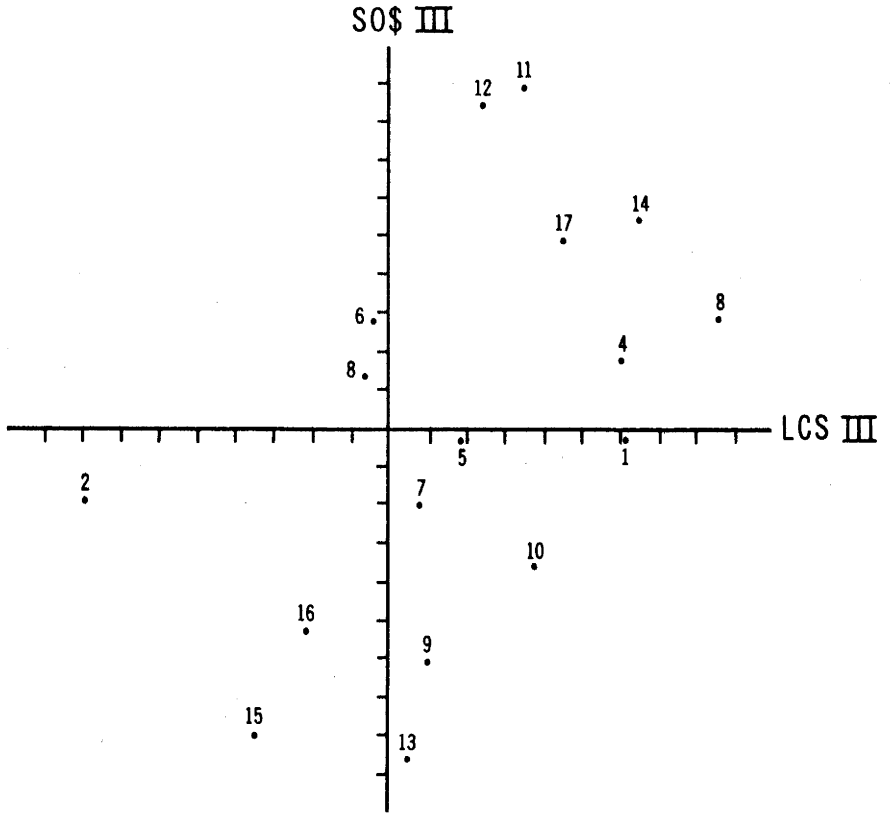
Broken diagonals show position of unrotated axes



G. 6: Melbourne, three factor



G. 7: Melbourne, three factor



G. 8: Melbourne, three factor

APPENDIX H

Q FACTOR ANALYSIS LOADINGS (TWO FACTOR SOLUTION)

	Sydney				Melbourne			
	Components		Varimax		Components		Varimax	
E.D.	1	2	1	2	1	2	1	2
A	.5264	.7573	.5125	.7668	.7405	-.6199	.9628	.0752
B	.8237	-.1533	.8263	-.1382	-.0336	.0749	-.0764	.0300
C	.9417	-.1856	.9449	-.1683	.4621	.7967	-.2273	.8925
D	-.0675	.8639	-.0833	.8625	.7307	-.5562	.9112	.1139
E	.8331	-.3997	.8402	-.3844	-.5036	.6207	-.7941	.0910
F	-.8507	.2829	-.8557	.2673	.7018	.6414	.0526	.9493
G	-.9511	-.2085	-.9471	-.2259	-.2936	-.8464	.3824	-.8101
H	-.2626	-.6950	-.2499	-.6997	.6311	.4819	.1137	.7858
I	-.9081	.0597	-.9090	.0432	-.5004	.6082	-.7831	.0844
J	.8456	.5103	.8362	.5257	.7990	.1066	.4963	.6352
K	-.6628	-.1108	-.6607	-.1229	.6511	-.7320	.9774	-.0674
L	.4685	.5601	.4582	.5686	.8945	.3294	.4086	.8612
M	.1238	-.6620	.1359	-.6596	-.3548	-.7338	.2599	-.7725
N	.8071	.1162	.8049	.1309	.8492	-.4610	.9293	.2649
O	.4385	.7859	.4240	.7938	-.2672	.7227	-.6966	.3294
P	.1563	-.8773	.1723	-.8743	.6981	.6068	.0741	.9219
Q	.0091	-.1383	.0117	-.1381	.1549	.3087	-.1053	.3289
R	.7546	.4089	.7470	.4226	-.8623	-.1560	-.5069	-.7148

APPENDIX H (continued)

Q FACTOR ANALYSIS LOADINGS (TWO FACTOR SOLUTION)

	Sydney				Melbourne			
	Components		Varimax		Components		Varimax	
E.D.	1	2	1	2	1	2	1	2
S	-.5086	-.6831	-.4960	-.6922	-.8350	.1534	-.7039	-.4747
T	-.3185	.8972	-.3348	.8912	-.9447	.0610	-.7176	-.6174
U	.6623	-.1707	.6653	-.1586	-.6848	.3275	-.7184	-.2451
V	.4448	-.8639	.4605	-.8557	-.8653	-.3919	-.3440	-.8854
W	-.7073	.5443	-.7172	.5313				
X	.0783	-.8653	.0941	-.8637				
Y	-.1328	.9004	-.1493	.8978				
Z	-.8711	.1111	-.8730	.0952				

INDEX : E.D. = Electoral division
Components = unrotated factors
Varimax = rotated factors