And Now for Something Different: Modelling Socio-Political Landscapes¹

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Abstract

GIS technology has been used to build an e-research facility whereby it is possible to on-line (a) investigate and visualise on-line spatial patterns of voter support for political parties at the local level of scale at federal elections in Australia, and (b) model the relationships between those voting data and variables derived from census data on the demographic and socio-economic characteristics of local populations. Using data on voting at the 2007 federal election and from the 2006 census, the paper shows that patterns of voter support for political parties have a distinct geography across Australia's cities and regions. Spatial and statistical modelling is used to derive spatial typologies of voter support for political parties and to identify key demographic and socio-economic factors that discriminate voter support for political parties. Clear socio-political landscapes are evident. The position of political parties in a two-dimensional socio-political space has changed over the last three federal elections, the first two of which in 2001 and 2004 saw the Coalition Government returned with strong majorities, while the third election in 2007 saw a marked voter swing to oust the Coalition parties and put the Labor Party into government.

¹ This paper is based on is Presidential Address by Robert Stimson delivered at the WRSA 2010 49th Annual Conference luncheon in Sedona, February 21-24.

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Introduction

Regional scientists rarely explicitly analyse spatial variation in demographic and socio-economic phenomena in a political context. In the late 1990s, a group at The University of Queensland began a program of research using GIS tools to integrate data on voting patterns at elections in Australia with the demographic and socio-economic characteristics of local area populations (Davies and Stimson, 1998; Stimson, McCrea and Shyy, 2006; Stimson, Chhetri and Shyy, 2007; Shyy, Stimson and Chhetri, 2007; Stimson and Shyy, 2009). Their interest was in mapping the spatial patterns of voter support for political parties, exploring the ecological correlations between spatial variations in voter support for a political party and the characteristics of local areas, and developing typologies of socio-political landscapes across Australia's major cities and its non-metropolitan regions.

That research effort culminated in the development of a GIS-enabled *e-research facility* (Liao, Shyy and Stimson, 2009)³ enabling anyone to access on-line integrated spatial databases relating to:

- levels of voter support for political parties at federal elections in Australia at the spatially disaggregated level of scale of local polling booths, and
- variables derived from census data on the demographic and socio-economic characteristic of populations living in local polling booth catchments.

Those data may be interrogated to:

- visualise the spatial patterns of voter support for political parties at a local area level of scale

³ The e-research facility may be accessed on http://e-research.geosp.uq.edu.au/aus_voting2007.html or through the web site sis.edu.au, go to Shared Research Resources and follow the instructions to access the voting databases.

- integrate those voting data with the demographic and socio-economic data derived from the census for local areas
- conduct on-line statistical and spatial modelling to investigate the ecological relationships between those local voting data and local census data variables, and to develop typologies of voter support for political parties, which are akin to socio-political landscapes.

Analysis of voting data can be undertaken across the nation as a whole, for a specific State or Territory, for a specific Electoral Division, or for a specific metropolitan region.

This paper provides an overview of how that e-research facility can be used to interrogate the data bases on voter support for political parties at the 2007 federal election with small area demographic and socio-economic data from the 2006 census.

Previous research investigating spatial patterns of voting at elections in Australia

Numerous research have investigated aspects of electoral geography in Australia by analysing voting data at a fine level of spatial disaggregation covering all of Australia for both major and minor parties. But those studies generally tended not be conducted at the level of spatial disaggregation undertaken by the authors and their collaborators (referred to above); nor did they have the level of detail in their analyses. They also tended to focus on particular political parties and/or on particular geographical areas, such as an Electoral Division or a State, or where a national-scale analysis was used was based on Electoral Divisions. Those previous studies include, *inter-alia*: AEC/IRS (1998); Forrest, Alston, Medlin and Amri (2001), Forrest (1982); Forrest (1988); Singleton, Martyn and Ward (1998); Taylor (2003).

Other research has explored relationships between socio-economic characteristics of voters and voting outcomes using survey data. The Australian Electoral Study is a comprehensive source of periodic survey data (see, for example, Jones McAllister and Gow, 1996; Bean, Gow and McAllister, 1999). Others have been of a political science nature (for example, Bean, Simms, Bennett and Wahurst, 1997; Manne, 1998) or have used survey data to link socioeconomic variables with attitudes to major election issues, voting intentions, and voting behaviour. Schram (1992) used predictive multi-nominal logit models to project results using

survey data variables. But such studies have tended to use survey data to relate characteristics of individuals to individual voting behavior using statistical analysis. They lacked a detailed spatial dimension and are impractical for analysing relationships between socioeconomic characteristics and voting outcomes for an entire country at a spatially disaggregated level of scale.

The data bases and the e-research facility

In Australia voting is compulsory for citizens aged 18 years and over, and at elections - which are always held on a Saturday - about 90% of voters cast their vote at their local polling booth. Thus spatial modelling of voting data, and matching it with the characteristics of local populations, is not fraught with methodological problems related to low voter turnout and a lack of spatial coincidence between where people vote and where they live.

Electronic records of data on the level of *voter support for political parties* at federal elections is available from the Australian Electoral Commission at the spatially disaggregated level of local *polling booths*. At the 2007 election there were 7,419 polling booths across the nation. That voting data is also aggregated into Electoral Divisions, which are the electorates for the 150 seats in the House of Representatives. The voting data is provided for all candidates representing a political party or who stood as an independent candidate at an election. As Australia has a preferential voting system, voting data is provided for both (a) the level of the first preference votes given to a candidate, and (b) the two-party preferred vote for Labor Party and for the Coalition parties (Liberal Party and National Party) candidates.

The location of the polling booths was *geocoded*, thus providing point-located voting dataset within a GIS. That enabled creation of a dataset for polling booths indicating the primary vote for all political parties and for independent candidates standing for the House of Representatives and also the two-party preferred vote for the Australian Labor Party (hereafter referred to as Labor Party or Labor) and for the Coalition (which comprise the Liberal party, the national Party and the Liberal-Country Party in the Northern Territory only) at the 2001, 2004 and 2007 federal elections.⁴

⁴ This is now being repeated for the 2010 federal election.

Local *polling booth catchments* were derived by allocating census collector districts (CCDs) to the nearest polling booth. In many cases in urban areas there was a polling booth in a CCD. Where there was more than one polling booth in a CCD (which is not uncommon in some urban areas), the voting data was aggregated for those booths. In rural areas the road system was also used as a guide to help aggregate CCDs to form polling booth catchments. Where possible this was done within the constraint of not having a polling booth catchment cross the boundary of an Electoral Division.

The CCD level data for the 2001 and the 2006 censuses were aggregated into the polling booth catchment spatial units. A dataset comprising 48 demographic and socio-economic variables derived from the 2001 census and the 2006 census was then generated (see Table 1). Those variables measure *demographic and socio-economic characteristics of local populations* living in the polling booth catchments.

[Take in Table 1]

The two data matrices (polling booths x voting for political parties, and polling booth catchments x demographic and socio-economic characteristics of the local populations living in those polling booth catchments) were integrated using GIS. The voting data for the polling booths at the 2001 and 2004 elections were integrated with the variables derived from the 2001 census, while the voting data for the 2007 federal election was integrated with variables derived from the 2006 census.

These datasets may be interrogated on-line to *visualise* patterns of voter support for political parties at an election, and those patterns of voter support for political parties at the disaggregated level of polling booths can be overlaid with patterns of a variable relating to the demographic and socio-economic characteristics of polling booth catchments at the census closest to an election.

In visualising the spatial patterns of the level of voter support for political parties at the disaggregated level of local polling booths the functions incorporated in the e-research facility make it possible to choose from a number of *classification procedures* to visualise the data and to zoom-in to focus on any geographic region/area large or small across Australia. The classification methods available are: equal interval; natural breaks; quantile; bi-criterion

median clustering; and a benchmarked measure using the Location Quotient for the vote for a political party.

Using the e-research facility, the *relationships* between those patterns of voter support for political parties and the demographic and socio-economic characteristics of local areas may be analysed and modelled using a variety of *statistical analysis tools*, including: regression analysis; line-fitting; cluster analysis; discriminant analysis; and principle components analysis⁵.

Visualising spatial patterns in of the vote for political parties at the 2007 federal election

The election result

At the 2007 federal election for the 150 Electoral Divisions in the House of Representatives, the Labor Party led by Kevin Rudd ended 11 years of government by the Coalition led by John Howard. There was a 5.3% national swing to Labor in the primary vote. The new Rudd Labor government attracted 52.6% of the two-party preferred vote compared with 47.4% for the Coalition Liberal and National parties. Labor won 83 seats in the House, a gain of 22 seats. The Coalition lost 20 seats. Independent candidates won 3 seats. That was a decisive victory for Labor.

A decade earlier at the 1996 election the Coalition had attracted a national swing of 6.2% in its primary vote - which ended up as a 3.9% gain in the two-party preferred vote for the Coalition - to throw out of office the Labor government which had been in power for 13 years.

The 2007 federal election thus represented a landmark shift in Australia's political landscape, especially as the Coalition's win at both the two previous elections in 2004 and 2001 federal elections had been so decisive.

⁵ The design of the e-research facility is explained in detail in Liao, et al. (2009).

Spatial patterns of voter support for Labor and for the Coalition

Interrogating the e-research facility and visualising the patterns of voter support for political parties at the 2007 federal election at the level of polling booths across Australia's cities and regions reveals a distinctive geography to the pattern of voter support for the Labor Party and for the Coalition parties. This is illustrated first in Figure 1, which shows the pattern in polling booths across the nation where the primary vote for Labor was greater than the primary vote for the Coalition, and vice versa. There are concentrations of voter support for Labor in many of the remote parts of Australia, where there were a lot of indigenous population settlements, and in and around some of the regional urban centres, particularly the larger coastal ones. However, widely across the rural heartland areas of Australia the Coalition tended to gain more of the primary vote than Labor⁶.

[Take in Figure 1]

Marked geographic differentiation in the patterns of voter support for Labor and for the Coalition was particularly evident in the five major metropolitan cities of Australia (Sydney, Melbourne, Brisbane, Perth and Adelaide) and their surrounds, where 7 out of 10 people in Australia live, and where thus the big majority of the 150 Electoral Divisions (seats) in the 150 House of Representatives are located. The distinctive political geography is illustrated in a map of voting at local polling booths in Melbourne, the nation's second largest city and the capital of the State of Victoria (Figure 2). The Labor vote dominates across the core and inner city areas, in the lower socio-economic status outer suburbs in the west and north and in the outer south east suburban areas that are industrial. The Coalition was dominant in the middle suburbs to the eastern and south east and in many of the outer suburban fringe areas.

[Take in Figure 2]

Similar distinctive geographic patterns in support for Labor and for the Coalition⁷ were evident in the other big metropolitan cities, even though the structure of the spatial patterns

⁶ This reflects the fact that many agricultural and pastoral regions are the homeland of voter support for the National party in the Coalition.

⁷ Note that in the metropolitan regions and many of most of the larger non-metropolitan urban centres in Australia it is the Liberal Party that represents the Coalition.

may be somewhat different in each case; but they did substantially reflect the pattern of socio-economic and ethnic dimensions of the population of those cities.

There was also a distinct geography to the pattern of voter support for the minor political parties. This is shown in Figure 3 using a natural breaks classification for the vote for the Greens in Sydney which was highly concentrated in the inner city suburbs. This translated into a high two-party preferred vote for Labor as the large majority of Green voter preferences flowed to Labor, thus ensuring Labor of electoral victory in inner city seats in the House of Representatives.

[Take in Figure 3]

Thus, across the major metropolitan city regions we find that the geography of voter support for both Labor and for the Coalition tends to be highly 'regionalised' to produce a marked spatially differentiated political landscape. An interesting characteristic of those political landscapes is that within most of the Electoral Divisions there tends to be a high degree of homogeneity in the dominant pattern of support for a major political party, be it for Labor or for the Coalition. Relatively few of the Electoral Divisions have heterogeneous pattern of party allegiance across polling booths.

Spatial patterns in the swing to Labor

The national swing to Labor in the primary vote was 5.6 %; and it was widely distributed, with Labor experiencing a positive swing to it in 6,377 (or 85.9%) of the polling booths across the nation. Swings to the Coalition were restricted to about 15% of polling booths, but those tended to be highly concentrated in a small number of Electoral Divisions that are the core areas of the Coalition's electoral heartland. And there were also swings to the Greens in the primary vote the in some polling booths, especially in the inner city areas. Furthermore, in a small number of Electoral Divisions in country regions, swings in the primary vote to Independent candidates were evident.

What was important in terms of the outcome of the election was how those swings in the primary vote to one political party (predominantly to Labor and to a lesser extent to the Greens) and away from another political party (predominantly away from a Coalition party),

ended up after the distribution of preferences affecting gains or losses in the two-party preferred vote for Labor and the Coalition. Interrogating the voting data base in the e-research facility reveals that in the metropolitan cities the swing to Labor was particularly marked in what has been referred to as the 'mortgage belt' across the middle and outer suburbs. The swing was also marked in and around many of the coastal urban centres - especially along the coast of Queensland. But even across much of the rural heartland areas there were swings to Labor. That resulted in Labor capturing a sufficient number of Electoral Divisions from the Coalition to propel Labor to government and cast the Coalition into opposition in the Lower House in the Commonwealth Parliament. These were seats in the House which the Coalition had held over a succession of previous elections

The 12 to 15 'swinging seats' across the 'mortgage belt' of the big cities are the where federal elections in Australia tend to be won or lost. Outside of them, the swings to Labor or to the Coalition have tended to be less likely to be translated into a loss of an Electoral Division in the House because of a long-standing preponderance of polling booths where one of the parties has tended to dominate the primary vote, and that has tended to be rather homogenous across the polling booths in many Electoral Divisions.

Thus, the big majority of Electoral Divisions across Australia's cities and regions are clearly parts of the political 'heartland' for either the Labor Party or of the Coalition parties, and swings to one party or the other are not much likely to lead to a change in electoral outcome in most Electoral Divisions.

Relating level of voter support of a political party to a demographic or socio-economic characteristics of local populations: simple ecological association analysis

Much political commentary on the outcome of federal elections in Australia has referred to those so-called 'political heartlands' which contain the core demographic and socio-economic constituencies for the Labor Party and for the Liberal Party and the National parties in the Coalition. Voting swings occur as a result of particular demographic and/or socio-economic groups losing confidence in the party in government or being attracted by proposals put forward by an opposition party.

It is instructive to be able to interrogate the e-research facility to look at the ‘match’ between the pattern of voter support for a political party across polling booths and the demographic and socio-economic characteristics of local populations.

For example, it is a widely held view that voters who are immigrants to Australia are attracted to the Labor Party, and indeed that seems to be the case when we visualise the pattern of the level of support for Labor with the incidence of persons born overseas in Melbourne, as illustrated in Figure 4. The overlay of spatial patterns in the distribution of these two variables would appear to support the proposition.

[Take in Figure 4]

While this type of visualisation is useful, the e-research facility enables us to be much more precise in investigation such relationships by conducting analyses on-line of such ecological relationships between variations in levels of voter support for political parties and the demographic and socio-economic characteristics of local populations. That can be done using the line-fitting routine available on the e-research facility. And that can be done at various levels of scale, such as for the nation as a whole, within a State or territory, within a metropolitan city, or within an Electoral Division.

An example will serve to illustrate how general insights may be gained into what type of voters supported a political party at the 2007 federal election through such simple ecological association analysis using the e-research facility’s *least-squared/robust regression* tool which produces a graph plotting how the primary vote for either the Labor Party or the Coalition in all the polling booths across Australia changed (that is, increased or decreased) with an increase in the incidence of a particular demographic or socio-economic variable characterising the population living in local polling booth catchments. Taking as an example the influence of *age*, Figure 5 demonstrates how there was a generational aspect to variations in levels of voter support for Labor and the Coalition. Clearly as the incidence of the young first time voter age group and GenY voters increases the level of the primary vote for Labor increased, and the support for the Coalition declines, whereas when the incidence of Baby-boomers and of the world War II generation increases so too did the primary vote for the Coalition. However, there does not seem to be much of a relationship between the incidence of GenX voters and a higher or lower level of support for either Labor or for the Coalition.

Also, where the proportion of males in local populations is high then the vote for Labor declined and the vote for the Coalition increased.

[Take in Figure 5]

Modelling socio-political landscapes

So far we have illustrated the capability to use the e-research facility to visualise patterns of voter support for political parties at an election, to interface those patterns with spatial patterns of demographic and socio-economic characteristics local area populations and, and to identify simple ecological associations between those phenomena across the polling booths and polling booth catchments. But the e-research facility can also be used to conduct multi-variate statistical modelling to undertake a more rigorous analysis of those relationships. In that way we can derive socio-political landscapes or polling booth voting typologies, differentiate between voting groups (of support for political parties) on the basis of the demographic and socio-economic characteristics of local polling booth catchment.

The voting outcome groups

The polling booth *voting outcome groups* can be formed by classifying polling booths across Australia into nine voting groups (Table 2) as measured by the level of the primary vote for the various political parties at the election. Each polling booth can belong only to one voting group⁸.

The dominance of the Labor Party and the Coalition parties is clearly evident. But a significant role was played by the Greens with that party's primary vote being 20% or greater in 274 polling booths (highly spatially concentrated). In 163 polling booths (also highly spatially concentrated) an Independent gained 20% or more of the primary vote. In 2007 Labor dominated the primary vote in an extra 849 polling booths compared with the vote at the 2004 election, while in 2007 the combined Coalition parties polled less well than Labor in the primary vote in 1,204 polling booths compared with its performance at the 2004 election.

⁸ The basis for doing that is discussed in detail in Liao, et al. (2009); Stimson and Shyy (2009). The process for forming voting groups for the minor political parties is somewhat arbitrary where 20% primary vote was the cut-off.

The Greens gained 20% or more of the primary vote in an extra 57 polling booths in 2007 compared with its performance at the 2004 election.

[Take in Table 2]

Discriminating between voting groups

The *discriminant analysis* tool⁹ in the e-research facility may be used to model the relationship between the patterns of support for political parties in polling booths across Australia (or, if one wished, at the State or territory level of scale or at the metropolitan region level of scale) and the demographic and socio-economic characteristics of the populations living in polling booth catchments.

In that way the chosen variables on which the polling booth voting groups are to be compared may be combined into a small number of *discriminant functions* that explain much of the total variance in the dataset being used. That approach has been used in the modelling conducted by the authors and their collaborators in their analyses of the results of the 2001, 2004 and 2007 federal elections in Australia (Stimson, et al. 2006, 2007; Stimson and Shyy, 2009).

When choosing to use all of the variables listed in Table 1 as predictors of voting support for political parties at polling booths across Australia at the 2007 federal election, the discriminant analysis tool generates a small number of significant discriminant functions (three in this case) which cumulatively explain 94.3% of the between-group variance across the first six voting groups listed in Table 2 (that is the major parties plus Independents and the Greens). Table 3 shows the variable loadings on the first three discriminant functions, with significant loadings of $\geq +/-.300$ being highlighted in bold.

[Take in Table 3]

Because the first two discriminant functions account for the large majority (50% and 28% respectively) of the variance, and because we want to be able to plot the position polling

⁹ Discriminant analysis is a tool specifically designed to detect differences between two or more groups *viz-a-viz* the scores of the voting groups listed in Table 2 on a set of variables - such as those listed in Table 1 - that are a database incorporated in the e-research facility.

booth voting groups in a two-dimensional socio-political space, our focus is on these first two discriminant functions. Following consideration of the variable loadings on these functions we may ascribed the following descriptors to those functions:

Discriminant Function 1 is described as an *asset poorer-multicultural-younger / asset richer-monocultural-older* function:

- The *asset poorer* aspect of the dimension represent places (that is, polling booths and their catchments) with a greater incidence of households that are public housing tenants and with a lower rate of home outright ownership; they are likely to have a higher rate of unemployment; and they are likely to have a greater incidence of workers in in-person service occupations and in the routine production occupations and of workers in administrative and support services industries. In contrast the *asset richer* aspect of the dimension relates to represent places with a higher rate of outright home ownership, and those places also tend to have a higher proportion of workers who are in the symbolic analyst occupations and of workers in the extractive industries.
- The *multicultural* aspect of the dimension reflects places with a greater incidence of persons born overseas, and especially from Asian countries of origin, and of people identifying themselves as Islamic and/or having another non-Christian religion. In contrast, the *monocultural* aspect of the dimension reflects places with a lower proportion of persons born overseas, a higher proportion of Anglicans.
- The age component of the dimension is such that the *young* aspect of the dimension reflects places with a greater incidence of one parent families and a higher proportion of generation Yers, while in contrast the *older* aspect of the dimension reflects places with a greater incidence of the pre-war and World War II generation and of the baby boomer generation, and they tend to have a higher incidence of couple households.

Discriminant Function 2 is described as a *lower income-lower socio economic status / higher income-higher socio economic status* function:

- The *lower income-lower socio economic status* aspect of the dimension tends to represent places that are characterised by a greater incidence of lowest income quintile households, have a higher proportion of workers in routine production

occupations, have a higher rate of unemployment, and have a greater incidence of one parent families.

- The *higher income-higher socio economic status* aspect of the dimension tends to represent places that are characterised by a greater incidence of highest income quintile households; have a higher proportion of workers with a university level qualification; and have a greater incidence of workers in the producer/business services industries and of workers in the symbolic analyst occupations. They have a higher proportion of people born in the UK, and tend to have a greater incidence of people with no religion. And they have a higher proportion of households connected to the internet.

Position of political parties in a socio-political space

By taking the z-score for every polling booth on the above two descriptive discriminant functions we can plot on a graph the position of all polling booths within each of the polling booth voting groups for political parties. The horizontal axis is the *asset poorer-multicultural-younger / asset richer-monocultural-older* discriminant function, while the vertical axis is the *lower income-lower socio economic status / higher income-higher socio economic status* discriminant function. Such a graph provides a visual representation of two concepts, namely:

- the differentiation between the groups of polling booths distinguished by the predominance of the vote for a political party; and
- the relationship of those polling booths *vis-à-vis* the demographic and socio-economic characteristics of polling booth catchments, as represented by scores on the first two discriminant functions.

The plot of position of the than 7,400 points (polling booth catchments) on those two dimensions may thus be interpreted as representing a type of *social-political space* for voting at an election for candidates for the House of Representatives seats. The plot can be simplified visually by just showing the position of the the ‘centroid’ of polling booth voting groups within that two-dimensional socio-political space).

The same approach is used to derive a socio-political space for voting at the previous federal elections in 2004 and 2001, and it is noteworthy that the same two dominant discriminant functions emerged. Thus the changing position of the centroid polling booth for the voting

groups within the socio-political space with respect to the two axes can be traced. This is shown in Figure 6.

[Take in Figure 8]

With regard to the position of the political party voting groups in the socio-political space for the 2007 election, Stimson and Shyy (2009: pp. 49-50) draw the following conclusions:

- The Labor Party is clearly separated from the other political parties, being located within the *asset poorer-multicultural-younger / lower income-lower socio economic status* quadrant of the graph.
- In contrast, the Liberal Party is located within the opposite *asset richer-monoculture-older / higher income-higher socio economic status* quadrant of the graph, its position is nearest the centre of the axes formed by the two discriminant functions.
- The National Party and the Independent are located in the *asset richer-monocultural-older / lower income-lower socio economic status* quadrant of the graph.
- The Australian Greens Party and the County Liberal Party (Northern Territory only) are both located in the *asset poorer-multicultural-younger / higher income-higher socio economic status* quadrant of the graph. There is a wide separation between the National Party and the Liberal Party within the Coalition, with the results from the discriminant analysis modelling demonstrating just extent to which the voting constituencies for the coalition partners are differentiated.

With regard to the over time ‘shifts’ in the position of the political parties in this ‘socio-political space’, Stimson and Shyy (2009: pp. 51) make the following conclusions:

- (a) The Liberal Party position in the ‘socio-political space’, while rather more marginally remaining within the *asset richer-monocultural-older / higher income-higher socio economic status* quadrant of the graph, is the most centrally placed of all the political parties within the overall ‘socio-political space. But the Liberal Party’s position has progressively shifted more towards the centre from the 2001 election to the 2004 election and finally to the 2007 election. Thus the Liberal Party seemingly has been surrendering some voter support in polling booths characterized by higher income and higher educated populations as well as the possibly foregoing some of the asset rich, monocultural and

older areas. In effect, the trajectory of the trend in the position of the Liberal Party in the ‘socio-political space’ from 2001 to 2004 has been the mirror-image of the trajectory of the Labor Party in that space between the 2004 election and the 2007 election.

- (b) The National Party’s position has remained firmly embedded within the asset richer-monocultural-older / lower income-lower socio economic status quadrant of the ‘socio-political space’, with only a relatively small movement between 2001 and 2007 a little bit more towards the middle of the income-socio economic status dimension.
- (c) The Country-Liberal Party (Northern Territory only) has had its position in the ‘socio-political space’ change little across the 2001, 2004 and 2007 elections, remaining in the asset poorer-multicultural-younger / higher income-higher socio economic status quadrant of the graph, more to the middle of the income-socio economic status (advantage / disadvantage) dimension.
- (d) The Greens Party remains within the asset poorer-multicultural-younger / higher income-higher socio economic status quadrant of the ‘socio-political space’ in Figure 16, and is further out than any of the other political parties along the higher income-higher socio economic status end of what is essentially an advantage /disadvantage dimension, and over time its position has been moving out towards the higher end of this dimension. However, its position on the asset poorer-multicultural-younger end of this first discriminant function had moved out further along that end of the dimension between the 2001 and the 2004 dimension before moving back more towards the middle of that dimension at the 2007 election.

Factors associated with the swing to Labor at the 2007 election

Understanding what factors relating to the demographic and socio-economic characteristics of local area populations might have been associated with the swing to Labor at the 2007 federal election in Australia might be enhanced through a multiple regression analysis of the relationship between spatial variations across polling booths in the magnitude of the swing in

the primary vote attracted by Labor and the demographic and socio-economic characteristics of polling booth catchments.

Stimson and Shyy (2009) have experimented with two methodological approaches:

1. First a step-wise multiple-regression analysis was run where the actual magnitude of primary vote swing to Labor 2004 to 2007 was the dependent variable and all 47 of the demographic and socio-economic factors in Table 1 were the independent variables. The results were disappointing yielding an R^2 of only 0.16, with no definitive explanatory variables being evident.
2. Second they focused specifically on the 1,049 polling booths where there was a larger primary vote for Labor than for the Coalition while at the 2004 election for those polling booths there was a larger primary vote for the Coalition than for Labor. The notion was that those were the polling booths where the voting switch would have been crucial in shaping the election result and the change in government. A step-wise multiple-regression was again used, resulting in an R^2 of 0.22. The results suggested that:

“...the magnitude of that shift to Labor had been greater in places where the local populations of polling booth catchments are characterised by a greater incidence of Anglicans, Catholics and people with other Christian religion, Indigenous people, people born in Asia, workers in the extractive industries, single parent households, and households connected to the internet. the magnitude of that shift to Labor had been less in places where the local populations of polling booth catchments are characterised by a greater incidence of migrants from the UK and workers in the producer services and business services industries.” (Stimson and Shyy, 2009: p. 54-55)

Conclusion

In this paper we have demonstrated how GIS-enabled analysis integrating spatially disaggregated voting data and census data within an e-research facility has enabled us to undertake spatial and statistical modelling to investigate the relationships between voting behaviour and the demographic and socio-economic characteristics of local populations in Australia, with visualisation of outputs. Such tools are widely used in regional science

analysis, but generally regional scientists have not paid much attention to incorporating spatial data on voting patterns into their analyses.

As demonstrated by the analysis of data relating to the 2007 federal election, it is evident that there are marked spatial patterns in voter support for political parties giving rise to distinctive party-political landscapes. We have shown how discriminant analysis may be used to provide deeper insights into how the demographic and socio-economic characteristics of local populations differentiate between political party voting groups and how it is possible to place those groups within a two-dimensional socio-political space.

In a broader context, the methodology and design of the e-research facility referred to in this paper has the potential for wide-spread innovation in regional science analysis through the integration of diverse spatial databases at a variety of levels of geographic scale to facilitate on-line access to data and enable researchers and students - and indeed members of the general public - to access, visualise and model data and the relationships between datasets and variables to conduct research on-line.

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Table 1: Variables derived from the 2006 Census representing the demographic and socio-economic characteristics of polling booth catchments

Age and sex	Residential stability/Mobility
% population males (MALES)	% of population not at the same address 5 years ago (MOBILE)
% population age 0-17 years children and youth (YOUTH)	
% population age 18-22 years first voters (FIRST)	
% population age 23-34 years (GENY)	Digital divide
% population age 35-44 years (GENX)	% dwellings (not population) using Internet (INTERNET)
% population age 45-59 years boomer (BOOMERS)	

<p>% population age 60-74 years (Post Depression Wartime Generation) (WW2GEM)</p> <p>% population age 75+ years (Pre Depression Generation) (DEPGEN)</p> <p>Family and household structure</p> <p>% single person households (SINGLES)</p> <p>% couple without children households (COUPLES)</p> <p>% one parent family households (ONEPARENT)</p> <p>% couples with children households (COUPCHILD)</p> <p>Housing tenure</p> <p>% households that are home owners (HOMEOWN)</p> <p>% households that are home purchasers (MORTGAGEES)</p> <p>% households that are private renters (RENTERS)</p> <p>% households that are public housing tenants (PUBHOUS)</p> <p>Ethnicity/race</p> <p>% indigenous persons (INDIG)</p> <p>% born overseas (IMMIG)</p> <p>% born in UK (UK)</p> <p>% born in Southern and Eastern Europe (SEEUROPE)</p> <p>% born in Middle East (MIDEAST)</p> <p>% born in Asia (ASIA)</p> <p>Religious affiliation</p> <p>% Catholic (CATH)</p> <p>% Anglican (ANG)</p> <p>% Pentecostal (PENT)</p> <p>% other Christian (OTHCHRIST)</p> <p>% Islamic (ISLAM)</p> <p>% other non-Christian religion (ONCHREL)</p> <p>% with no religion (NORELIG)</p>	<p>Engagement in work</p> <p>Labour force participation rate (INWORK)</p> <p>Unemployment rate (UNEMPLOY)</p> <p>Industry of work</p> <p>% employed in Extractive Industries (EXTRACT)</p> <p>% employed in Transformative Industries (TRANSFORM)</p> <p>% employed in Distributive Services (DISTRIB)</p> <p>% employed in Producer/Business Services (BUSSERV)</p> <p>% employed in Social Services (SOCSERV)</p> <p>% employed in Administrative & support services (ADSS)</p> <p>% employed in Personal Services (PERSERV)</p> <p>Occupation * (Robert Reich's categories)</p> <p>% employed as routine production workers (ROUTPROD)</p> <p>% employed as in-person service workers (INPERS)</p> <p>% employed as symbolic analyst (SYMBA)</p> <p>Human capital</p> <p>% persons age 15 years and over with a degree or higher qualification (DEGREE)</p> <p>% persons age 15 and over with a certificate, diploma or advanced diploma (CERTDIP)</p> <p>Income[#]</p> <p>Low income category – % households in the lowest quintile for household weekly income (less than \$650) (LOWINC)</p> <p>Middle income category –% households in the middle three quintiles for household weekly income (\$650-\$1,999) (MIDINC)</p> <p>High income category -% households in the highest quintile for household weekly income (\$2,000+) (HIGHINC)</p>
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*The occupation categories relate to those proposed by Robert Reich, *The Work of Nations*, Vintage Books, New York, 1991. Broad occupations in the 2006 Census of Population and Housing are grouped to approximate the Reich categories.

[#]Uses mean gross household income per week in 2006 dollars (*Household Expenditure Survey, Australia: Summary of Results, 2003-04*) (6530.0) as a reference to derive quintile groups.

(Source: The authors.)

Figure 1: Spatial pattern of the vote at the 2007 federal election in polling booths across Australia where the primary vote for Labor is greater than for the Coalition (dark grey) and where the primary vote for the Coalition is greater than for Labor (light grey)

(Source: The authors.)

Figure 2: Spatial pattern of the vote at the 2007 federal election in polling booths across Melbourne where the primary vote for Labor is greater than for the Coalition (dark grey) and where the primary vote for the Coalition is greater than for Labor (light grey)

(Source: The authors.)

Figure 3: Spatial pattern of the Green vote at the 2007 federal election in polling booths across Sydney

(Source: The authors.)

Figure 4: Integrating visualisation of the pattern of levels of voter support for the Labor Party at the 2007 federal election and the incidence of persons born overseas across local areas in Melbourne

(Source: The authors.)

(a) Labor

(b) Coalition

Figure 5: The relationship between the level of (a) the primary vote for Labor and (b) the primary vote for the Coalition at polling booths across Australia and the incidence of population generational groups and of males in polling booth catchments

(Source: The authors.)

Table 2: Descriptive statistics and number of polling booths across Australia by favourable voting outcomes for political parties at the 2004 and 2007 federal elections for the House of Representatives

Polling booth voting Groups <i>vis-à-vis</i> Level of voter support for a political party	Mean vote (percent) 2007	Standard deviation (percent) 2007	Number of polling booths 2004	Number of polling booths 2007	Change between 2004 and 2007 elections
1. Labor Party - most primary votes	40.34	15.19	2,227	3,076	+849
2. Liberal Party - most primary votes	34.35	20.99	3,879	2,947	-932
3. National Party - most primary votes	9.91	20.30	1,199	932	-267
4. Country Liberal Party* - most primary votes	34.54	18.19	32	27	-5
5. Independents - most primary votes	2.60	8.70	**	163	**
6. Australian Greens Party - 20%+ primary vote	7.53	5.56	217	274	+57
7. Australian Democrats Party - 20%+ primary vote	0.63	0.80	1	0	-1
8. Family First Party - 20%+ primary vote	1.91	1.83	1	0	-1
9. CDP Christian Party - 20%+ primary vote	0.79	1.27	**	0	**
TOTAL			7,556***	7,419****	

* Note that the Country Liberal Party only operates in the Northern Territory where its candidates stood for the coalition.

** Voting outcomes of Independent and CDP Christian Party were not included in the spatially disaggregated modelling of voting outcomes and socio-economic characteristics at the 2004 Australian federal election.

*** 19 polling booths at the 2004 federal election could not be allocated to a party on the criteria used here as two parties hold equal percentages of primary votes in those polling booths.

**** 20 polling booths at the 2007 federal election could not be allocated to a party on the criteria used here as two parties hold equal percentages of primary votes in those polling booths. Note: 2004 election results are from Stimson, et al. (2007).

(Source: Stimson and Shyy, 2009.)

Table 3: Functional loadings of predictor variables loading on discriminant functions 1, 2 and 3

Predictors	Function 1	Function 2	Function 3
EXTRACT	-.550	+.277	-.216
ONEPARENT	+.543	+.323	+.029
IMMIG	+.494	-.232	+.133
HOMEOWN	-.481	+.040	+.015
GENY	+.458	-.052	-.215
SYMBA	-.437	-.358	-.364
ANG	-.414	+.229	-.069
ADSS	+.387	-.151	+.144
DISTRIB	+.358	-.029	+.329
BOOMERS	-.356	-.133	-.170
PUBHOUS	+.353	+.213	+.040
ASIA	+.348	-.035	+.143
ONCHREL	+.346	-.101	-.036
INPERS	+.320	-.030	+.169
ISLAM	+.309	+.120	+.118
WW2GEN	-.300	+.094	+.046
NORELIG	+.136	-.582	-.325
INTERNET	-.085	-.548	+.048
UK	+.024	-.541	+.163
HIGHINC	+.017	-.509	+.137
BUSSERV	+.186	-.497	+.020
DEGREE	+.104	-.496	-.200
LOWINC	-.022	+.432	-.204
ROUTPROD	+.347	+.423	+.339
UNEMPLOY	+.308	+.357	-.162
TRANSFORM	+.282	+.021	+.423
COUPLES	-.319	-.097	-.355

Note: The table includes only those variables with a loading of $\geq +/-.300$ on at least one of the first three discriminant functions.

(Source: Stimson and Shyy, 2009.)

Note: The figure shows the plot of the position of the centroid polling booth for the voting groups on the axes of the first two discriminant functions and how that position has shifted from across the 2001, 2004 and 2007 federal elections.

Figure 6: The changing positions of political parties in a socio-political space over the last three federal elections 2001, 2004 and 2007

(Source: Stimson and Shyy, 2009.)

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