THE EFFECTIVE SPACE OF PARTY COMPETITION

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We conclude that greater attention should be paid to the factors driving changes in the number of observable parties, the key variable determining the size and patterning of effective competition space. More generally, we demonstrate the value of a relativized approach to measuring and comparing patterns across elections. Whenever an index score changes from one election to another, the frame within which the index scores are determined also often changes.

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THE EFFECTIVE COMPETITION SPACE IN GENERAL ELECTIONS

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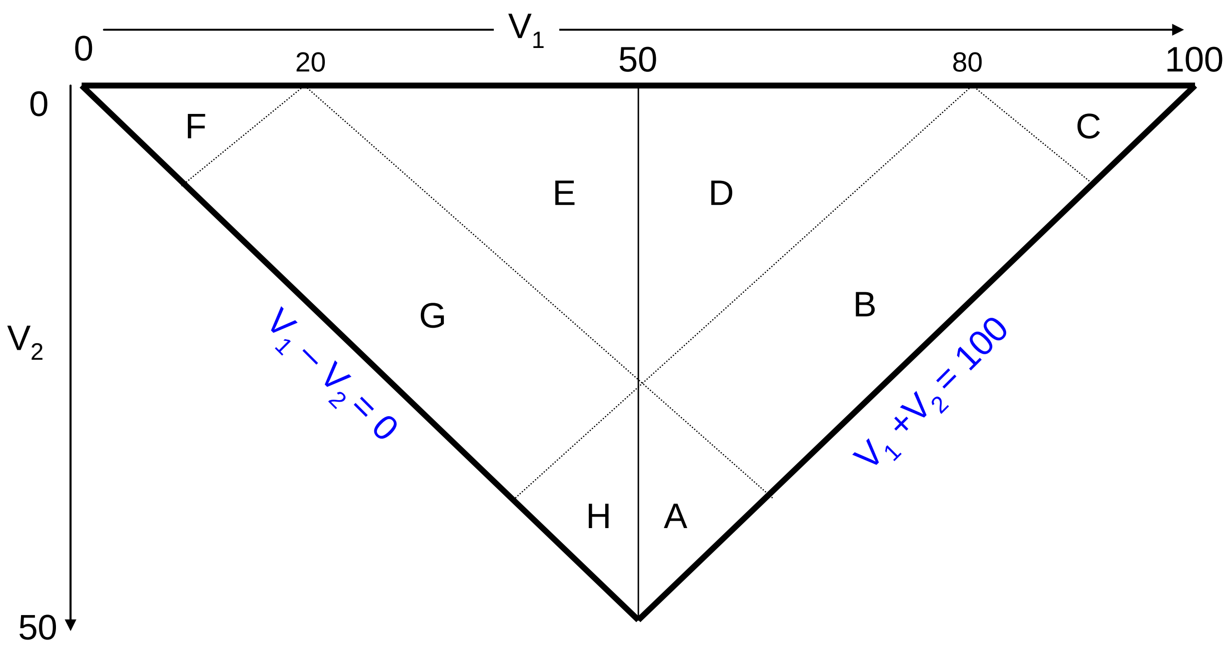
In the comparative analysis of elections and party systems, indices play an absolutely key role (Taagepera and Shugart, 1989). Yet some apparently simple measures can easily be misconstrued, disguising important features from analysts and creating an unreflective reliance on scores or indices, construed as absolute or unchanging numerical scales. Appendix 1 gives brief details of two important recent cases, involving a distorting version of the deviation from proportionality measure and the complex nature of the 'effective number of parties' measure. Once initiated, mistakes made in the original articles can continue to ripple on through the literature for lengthy periods as new authors pick up on tools for analysing their own particular empirical problems.

In this paper we show that the developing use of a triangle display to picture party competition in comparative politics is another such instance of this process, but that the approach can be valuable, once approached in a better-formulated way. Section 1 shows how the current two-dimensional triangle displays rest on a conceptual fallacy and must be fundamentally modified. It introduces a foundational concept for studying all forms of votes-based contest, the *effective competition space* in its simplest, two-dimensional form (ECS_2). We next explore how the ECS_2 concepts can be operationalized in detail to yield new insights into empirical data, in this case drawn from recent Indian general elections. Section 3 briefly outlines more inclusive three-dimensional and multi-dimensional concepts of effective competition space and points to some additional insights but also difficulties in operationalization with them. The conclusions argue that appreciating changes in effective competition space is fundamental for effectively analysing elections and party competition over time or across countries. A stronger focus is needed in comparative electoral and party analysis on the number of observable parties (N_{op}). N_{op} is a key variable shaping the size and structure of the ECS area, but it has been little studied in the past.

1. TRIANGLE DISPLAYS AND EFFECTIVE COMPETITION SPACE

The conventional use of a triangle display was pioneered by Nagayama and has been energetically promoted by Grofman et al (2004) and Taagepera (2004). Figure 1 shows the basic triangle display, inverted for reasons that will become obvious later on (when we introduce 3D displays). The top horizontal axis shows V_1, the vote share of the largest party, and the downwards vertical axis shows V_2, the vote share of the second largest party. The triangle is defined by the horizontal axis and the two bold lines here, $V_1=V_2$ and $V_1 + V_2 = 100$. These lines intersect where both V_1 and V_2 equal 50, the logical maximum for V_2 under any pattern of party competition. V_1 and V_2 can both win votes from, or lose votes to, other parties whose support is not shown. Taagepera (2004, 2006) has recently argued that triangle displays can also be used to graph the distribution of vote shares for the third-, fourth- or fifth-largest parties (peaking at 33.33, 25 or 20 per cent respectively), where these are particular

Figure 1: The basic triangle display (after Grofman et al)



foci of interest.[1]

Triangle displays have been mainly used at the aggregate level to show the local seats outcomes in multi-party elections. A cluster of seats outcomes close to the left-hand boundary indicates multi-party competition, while a bunching of outcomes close to the right-hand boundary shows a polarized party system, with just two leading contenders. Some analysts argue that sub-dividing the triangle display and counting the distribution of constituency outcomes across these partitions is a useful means of generating quantitative data for comparisons across elections. Grofman et al (2004) frankly admit that the triangle can only be internally partitioned in ad hoc ways. But they none the less recommend the sub-divisions shown in Figure 1, created by lines set in from the two sloping triangle boundary lines by 20 per cent and by a vertical line through $V_1 = 50$. The percentage of constituency results that fall into the different compartments can be calculated and considered as numerical tables, or used as a new variable for inputting into further quantitative analysis. The authors suggest, for instance, that the percentage of results in compartments ABC in Figure 1 can be taken as indicating bipolarized results, while the proportion in FGH indicates multi-party results. Because many analysts are seeking means of comparing and evaluating results across countries or elections, these ideas for compartmentalization have already been widely taken up. They are likely to serve as 'focal points', with the same divisions being used in many different situations.[2]

The problem here lies in interpreting the triangle display boundaries and the assumed internal uniform distribution of possible outcomes in absolute terms, as fixed things applicable across different competitive contexts. Grofman et al, and other authors following their lead (such as Taagepera, 2004), clearly assume that an underlying uniform distribution of constituencies is feasible across the whole triangle space, against which empirical patterns of seats are explicitly being compared. In fact for any given configuration, large areas of the triangle will not be open to being populated with results, so that the compartmentalization suggestions in Figure 1 are particularly inappropriate. They necessarily confuse some technical or mathematical effects within multi-party competition with substantive empirical patterns.

Yet we also want to show that a more sophisticated or *relativized* version of triangle displays can be highly illuminating in picturing variations in electoral systems operations comparatively and over time. As with the two instances mentioned in Appnedix 1, the key insight needed is that the scores associated with elections and party competition are not measured against unchanging, absolute scales. Instead, we have to see the score as produced within a whole display or mapping, many elements of which will themselves change in response to shifts in the situation being measured (Dunleavy, 1996; Dunleavy and Margetts, 1994). In electoral situations the changing party system conjuncture being mapped will typically reshape what index scores are logically possible, as well changing as the index scores on which attention mostly focuses. We show that an especially important effect is exercised by a variable that has been empirically neglected and theoretically assigned little importance in previous work, namely the number of ‘observable’ parties in competition.

In the remainder of this paper, to aid the exposition and to keep concepts and counting as simple as possible, we assume that we are dealing with an ‘integer universe’, where all election outcomes produce whole number vote shares for all observable parties. This is a very useful simplifying approach, already pioneered in the context of legislatures by Laver and Benoit (2003) and Benoit and Laver (2005). Here it also means that any ‘observable’ party competing in elections must by definition get at least 1 per cent of the votes. Below we show how this approach can be translated in simple ways into empirical analysis. At the most general level we seek to analyse the *effective competition space (ECS),* where ECS is defined as all the outcomes that are logically feasible between parties (or blocs) in a competition, denominated in terms of the number of integer ‘slots’ that are feasible in any situation. For instance, in perfect two-party contests there are just 50 whole-number slots on the line from the V_1, V_2 co-ordinates (100,0) to (50,50). For any given number of observable parties (those receiving 1 per cent of the vote or more), what shape will the available ECS space take? And how large will it be? (How many whole integer ‘slots’ will be available)?

The concept of effective competition space has immediate application in two significant areas (see Dunleavy and Dunleavy, 2007):

(i) *at an aggregate level* in analysing patterns of performance across multiple individual contests in an overall competition, as with patterns of constituency outcomes in a general election, analysed here; and

(ii) *at an individual contest level* where competing blocs have weighted votes, as with parties competing in a legislature or shareholder blocs competing for control of a company.

In this paper we focus solely on application (i), but it is worth noting that the ECS concept also has great application in the second sense above, especially to problems of attributing power to actors.

There are several important variants of the effective competition space concept, but we concentrate attention here on ECS_2 , the (apparently) simplest two-dimensional version, showing only the space for the top two parties, as in the conventional triangle display. This is an undeniably limited view and in Section 3 we briefly indicate and discuss other versions of ECS. But a possible theory justification here for focusing on just ECS_2 is that we know from many different sources that the two leading party contenders are critical for how electoral competition operates. V_I and V_2 will normally command a large (often dominant) proportion of attention from voters or other observers and actors in the political process, such as the media. Additionally ECS_2 is easy to chart visually, and it does not require any high quality information on the individual vote shares of the smaller $V_3..V_N$ parties - data which are often hard to obtain in comparative elections research.

The formulae defining effective competition space and the conventional triangle display for the lines joining up the triangle are given below:

	Effective competition space	Conventional triangle display
Left boundary (A' to B')	$V_2 = V_1$	
Right boundary (B' to C')	$V_2 = 100 – V_1 – (N-2)$	$V_2 = 100 – V_1$
Top boundary (A' to C')	$V_2 = (100-V_1)/(N-1)$	0

At first sight the differences are not large, but Figure 2 shows that depending on the number of parties, the effective competition space varies a great deal in its size and shape. The central example here is a system with ten observable parties, whose ECS is outlined in orange and shaded yellow. The boundary line A'B' is shared with the conventional triangle display, although only part of this line is feasible in any ECS plot. It says that the second largest party cannot be bigger than the largest one, so that at a limit $V_2 = V_1$ (in which case we could only randomly designate which of the tied parties was V_1 or V_2). Point A' is the high point of support for parties $V_3..V_N$ (which we often abbreviate below as V_{rest}), defined by an equal partition of the vote amongst *all* the observable parties, with ten observable parties at (10, 10, 80).[3] The B'C' boundary says the second largest party's vote share cannot exceed the remainder left

Figure 2: How the shape of the effective space for competition between the top two parties varies with changes in the number of observable parties

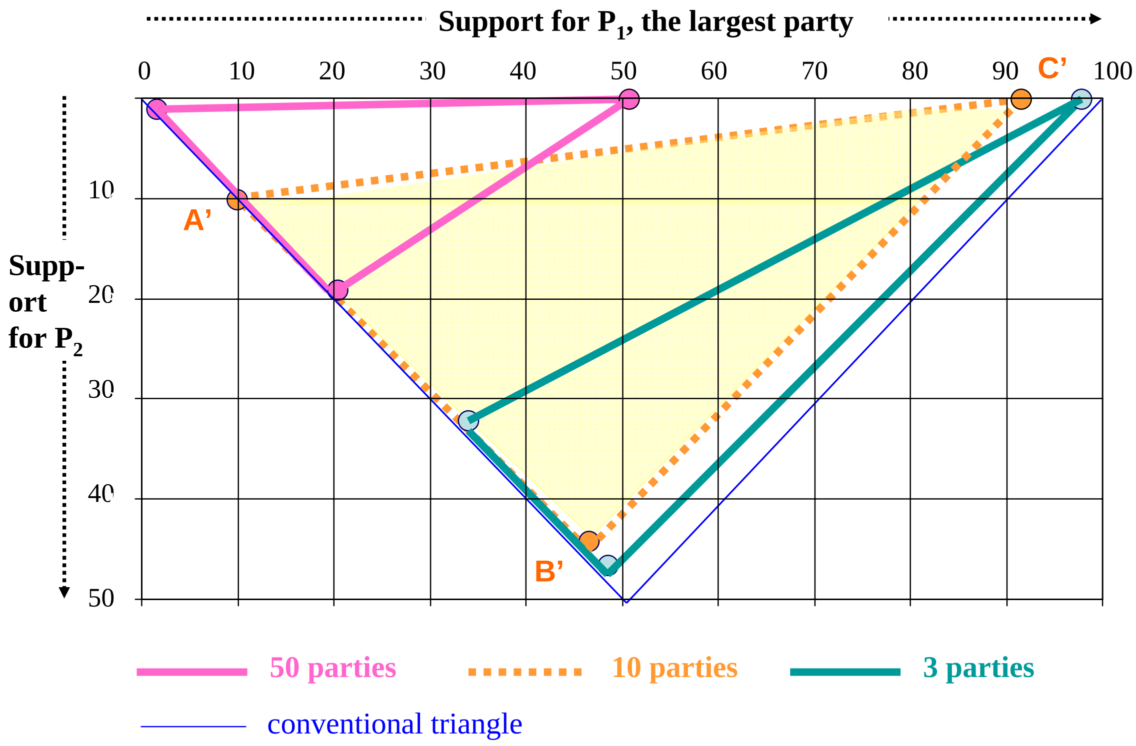
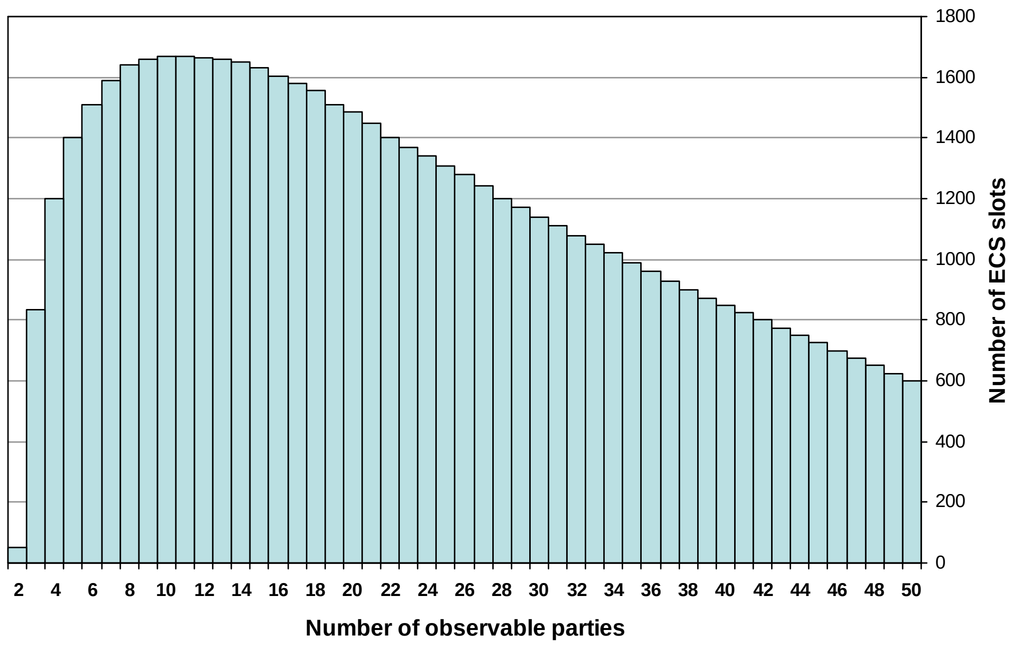


Figure 3: How the number of V_1/V_2 slots in the two-dimensional effective competition space varies with the number of observable parties



when we subtract from 100 both V_1 and at least 1 per cent each for all parties. The A'B' and B'C' boundaries intersect at B' to define a maximum size for V_2, where each of the smaller parties has 1 per cent support, and V_1 and V_2 divide the reminder equally - in a ten-party system at the coordinates (46, 46, 8). Finally, whereas the conventional triangle display has no top boundary, in Figure 2 the A'C' line defines a *minimum* size limit for V_2 given the size of V_1, namely that V_2 cannot be smaller than the third or later ranked parties. The equation $(100\text{-}V_1)/(N\text{-}1)$ gives the second largest party an equal share of the overall opposition vote (in a ten party system, one ninth). The B'C' and A'C' boundaries intersect at C' (whose co-ordinates are 91, 1, 8 with ten observable parties). At C' the largest party V_1 reaches its highest possible level of support and all observable opposition parties have 1 per cent votes each.

We do not begin looking at a ten party system by accident. Figure 3 shows that the *number of slots* in the two-dimensional effective competition space increase sharply from 50 with two observable parties to a peak at 10 and 11 parties of 1650 slots, the maximum number of V_1 and V_2 combinations. Within the conventional triangle display there are 2,500 slots (in an integer world)[4] for all possible electoral situations. At 10 parties ECS_2 accounts for two thirds of this total. To the left of this peak in Figure 3, the effective competition space shrinks to just 834 slots with three parties, only a third of the conventional triangle display slots. Beyond 11 parties the range of V_1 begins to shrink, also constraining the range of V_2. The B'C' boundary moves left and up towards A' by one notch with each increase in N_{op}, and the number of ECS_2 slots falls gradually and at a slowing rate.

Figure 2 shows that the shape (as well as the size) of the competition space also varies sharply with the number of observable parties. With N_{op} at 3 the ECS overlaps only around a quarter of its size at 10 parties. Beyond the peak size of 10-11 parties more gradual change occur with large numbers of observable opposition parties, as V_1's maximum size becomes more and more constrained in an integer world. For instance, with N_{op} at 50 then ECS_2 is only around a quarter its size at 10 parties and the ECS areas restricted to the upper right area adjacent to A'. In our integer world, ECS_2 reaches a minimum size of 1 slot when there are 100 observable parties each on 1 per cent support – an entropic state. Note that because N_{op} includes all parties with at least 1 per cent support, the levels for this measure are normally (i.e. outside the USA) much higher than counts such as the effective number of parties.[5]

Figure 2 also shows how misleading is the Grofman et al suggestion of partitioning the conventional triangle display in order to analyse constituency outcomes patterns. In any given configuration much of the conventional triangle will *necessarily* be empty. Depending solely on the number of observable parties, it will be logically and mathematically impossible for there to be V_1V_2 combinations located there. This is especially true for all of the areas labelled F and large parts of G and E in Grofman et al's Figure 1 when there are only a few parties in competition. And (in an integer world) Grofman et al's areas A, B, C and H will necessarily be completely unpopulated when there are more than 20 parties in competition. We conclude that it is vitally important for analysts not to construe the distributions of constituency data points as signifying the intensity or extent of party competition without first establishing how the effective space of party competition has itself shifted as a result of changes in the numbers of parties in competition.

2. EMPIRICALLY APPLYING ECS_2 DISPLAYS

Do the constructs set out above help generate any insights in analysing messy empirical data, or not? We seek to show how the apparently recherché concept of effective competition space can be usefully applied by comparative politics analysts coping with some methodological problems generally encountered in varied political environments on the ground. And whereas the difficulties set out above might seem to counsel against trying to analyse competition space at all in aggregate electoral analysis, we want to show that this implication is incorrect. It is very useful indeed to look carefully at changes in the proportions of constituency vote outcomes that fall within some well-defined sub-areas of the competition space.[6]

India is of course the world's largest functioning democratic system, and yet it is neglected in many seminal electoral analysis texts by Western authors (such as Cox, 1997). It provides a fascinating example of where the maintenance of plurality rule elections at all levels of the political systems has none the less progressively coincided with more and more parties entering competition. Consequently Indian general elections seem an appropriate test environment to show how the concept of effective competition space illuminates the empirical patterning of constituency vote outcomes. We focus attention here on four general elections, held in 1977, 1984, 1996 and 2004, whose salient features we briefly describe here.[7] For much of its post-independence history, Indian politics was dominated by the Congress party. Between 1952 and 1967, Congress was a very hard-to-challenge dominant party, straddling the median voter position and with deeply divided opposition parties situated on its ‘left’ and ‘right’. Even after 1967, Congress remained firmly in control of the national and state political scene until the first of our contests here. The 1977 general election was held after the traumatic ‘state of emergency’ period, pursued by Indira Gandhi when Prime Minister. Congress suffered a party-split, and was defeated by the Janata Party, a coalition of opposition parties temporarily united by their antipathy to the emergency regime. This coalition later split and Congress returned to power in the 1980 elections. The 1984 election took place after the assassination of Prime Minister Indira Gandhi, with Congress winning by a wide majority, helped by a sympathy vote. Both the 1977 and 1984 elections provided decisive majorities for the winning party. The concentration of votes on both occasions also produced the lowest national effective number of parties (votes) scores across all 14 general elections in India since independence, just 3.4 parties in 1977 and 3.8 in 1984.

In the 1989 elections, Congress was defeated by an opposition coalition of the National Front/Janata Dal. During the 1990s party fragmentation continued to increase, but coalition politics also became the norm. The party system has moved towards a multi-party system with two dominant blocs, led by Congress and the Bhartiya Janata Party (BJP). However, it has also been difficult for the resulting coalition or minority governments to last for their full term, leading to four elections between 1991 and 1999. The period from 1996 to 1998 was marked by some strong political instability. The 1996 general election, the third contest we focus on here, lead to a government first being formed by the BJP, followed by a United Front coalition. In 1998, the BJP formed the National Democratic Alliance (NDA) with smaller regional parties, and became the first non-Congress and coalition government to complete a full five-year term. In the latest 2004 elections, our fourth case, this BJP-led coalition, the NDA lost to a Congress-led coalition, the United Progressive Alliance (UPA). Congress’s unexpected success in 2004 was largely a result of its alliance with state or regional parties that enabled the main party and its allies to win a majority of the seats in the parliament. This phase of coalition politics has also led to an increase in the national effective number of parties, from 4.8 in 1989 to 7.1 in 1996 and 7.6 in the 2004 elections.

Thus, the Indian party system has evolved from being a dominant party system with Congress as hegemon up to the 1970s, to the current situation where national parties are increasing incapable of winning a parliamentary majority on their own, and must engage in coalition politics to win seats and form governments. The 1977, 1984, 1996 and 2004 elections are a suitable set of consider. They produced contrasting results and they clearly show the changing nature of party competition in Indian politics. Both the 1977 and 1984 elections produced decisive and one-sided victories, while the 1996 and 2004 elections were held in the phase of coalition politics, and produced a fragmented parliament and coalition governments.

With 44 parties represented in the Lok Sabha, and a current governing coalition drawing support from 18 of them, India seems at first sight to be a complete exception to Duverger's 'Law' processes at national level. Partly this reflects India's strong ethnic, religious and linguistic diversity, however, and we can control for much of this social heterogeneity by focusing analysis at the state and constituency levels. Here some analysts have claimed that the concentrating effects of plurality rule elections predicted by Duverger can still be seen, even in modern times (Sridharan, 1997; Chhibber and Kollman, 2004). More critical studies argue that even here the evidence for Duverger's law effects is at best equivocal, and that in many large Indian states and general election constituencies the effective number of parties has grown over time (see Diwakar, 2007; Chhibber and Murali, 2006). Diwakar (2007) uses conventional triangle displays to show that in the 1970s most of the 550 general election constituency outcomes clustered strongly around the axis signifying two-party competition. But in the 1990s and in 2004 many more constituency outcomes moved into the zones of the triangle with multi-party competition.

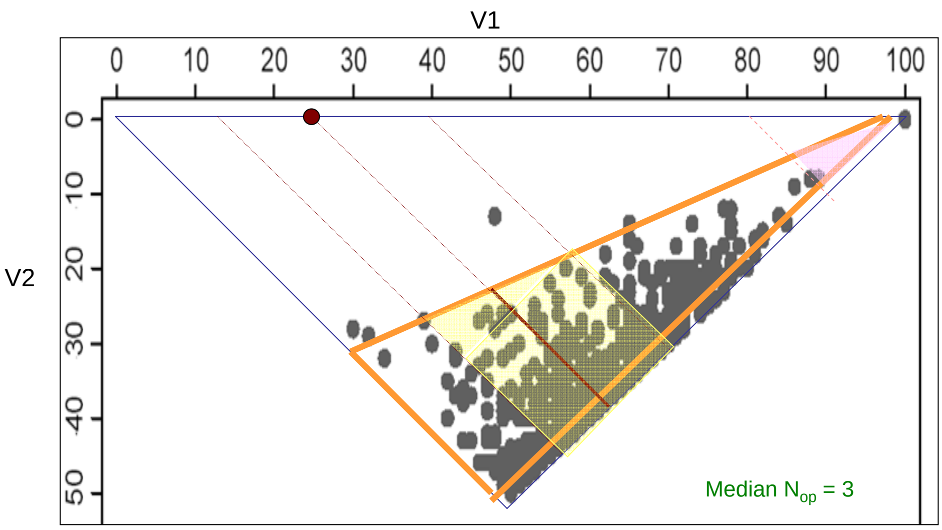
In this period the median for constituencies' number of observable parties (hereafter N_{op}) grew slowly from 3 to 5, shown in Figure 4 below. The largest N_{op} number in any constituency grew from 8 in 1977 to 14 in 1996 before falling back. We use the median N_{op} number to define the A', B' and C' points of the median constituency's ECS_2 space in accordance with the Table of Values set out in Annex A. The key question then is, how useful is looking at the ECS_2 boundaries thus defined for understanding trends in the Indian constituency outcomes?

Figure 4: Background data on parties competing in Indian general elections, 1977-2004

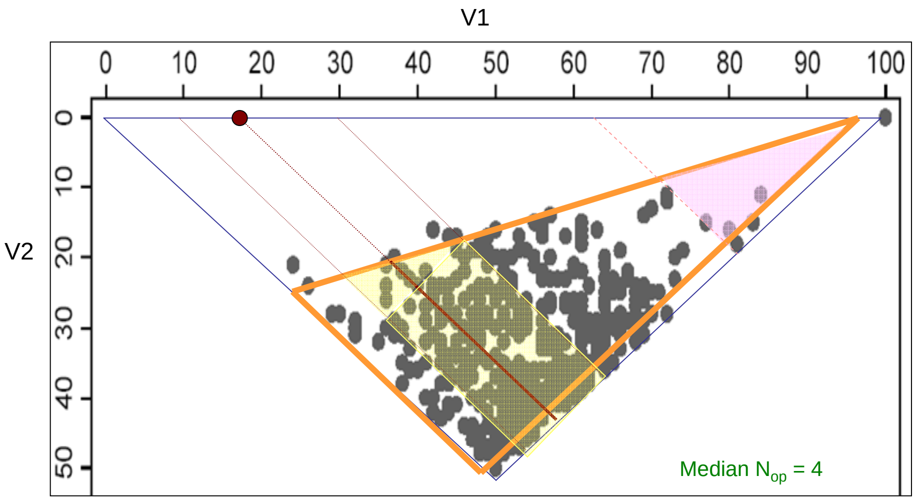
Across 550 constituencies:	1977	1984	1996	2004
Median score for number of observable parties (N_{op} = securing 1% vote or more)	3	4	5	5
Maximum score for NOP	8	12	14	11
Median for total number of parties securing any votes	5	10	24	10
Maximum for total number of parties securing any votes	14	42	70	35
Maximum vote share (%) going to V_{rest} parties	43	54	63	51

Figure 5 shows the four election outcomes, in each case with overall triangle suggested by the conventional display and then the median ECS_2 shape within it. It is immediately apparent that the median effective space captures very important changes between the general elections in an immediate and graphic way, with the vast bulk of observations in each case falling within the ECS area. Because the ECS area is only drawn for the median constituency, however, it is perfectly possible for observations to fall outside its frame. There are very few constituency outcomes north of the median ECS area, but a large number of them falling below it, indicating constituencies where party competition is limited to just one or two main contenders and the V_{rest} vote is very small indeed. This effect was very pronounced in the strongly polarizing post-Emergency election in 1977. It reduced a lot in 1984, and almost disappeared in 1996. Constituencies falling below the ECS area returned strongly in the 2004 election, when a Congress-lead coalition managed to oust the BJP-lead government. The numbers of constituencies can be counted for the three areas and Figure 6 shows the results. This partitioning is the first and most basic way in which the ECS helps to illuminate the structure of the outcomes.

Figure 5: The effective competition space in the Indian general elections of 1977, 1984, 1996 and 2004



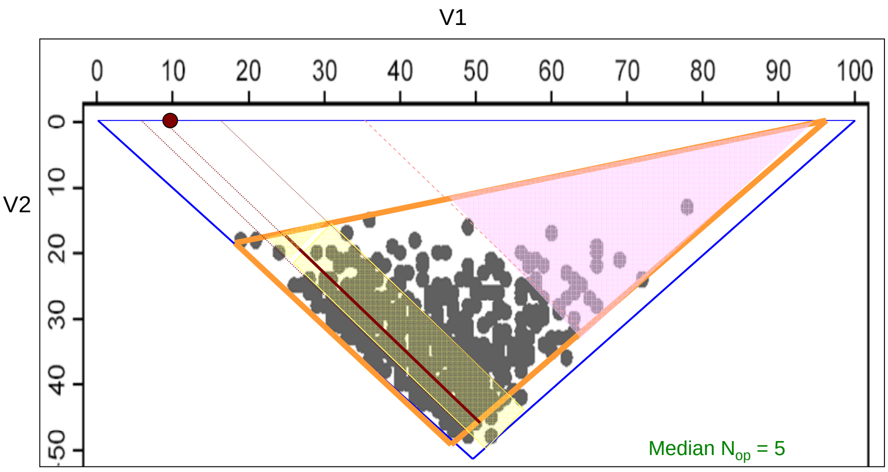
1977 general election



1984 general election

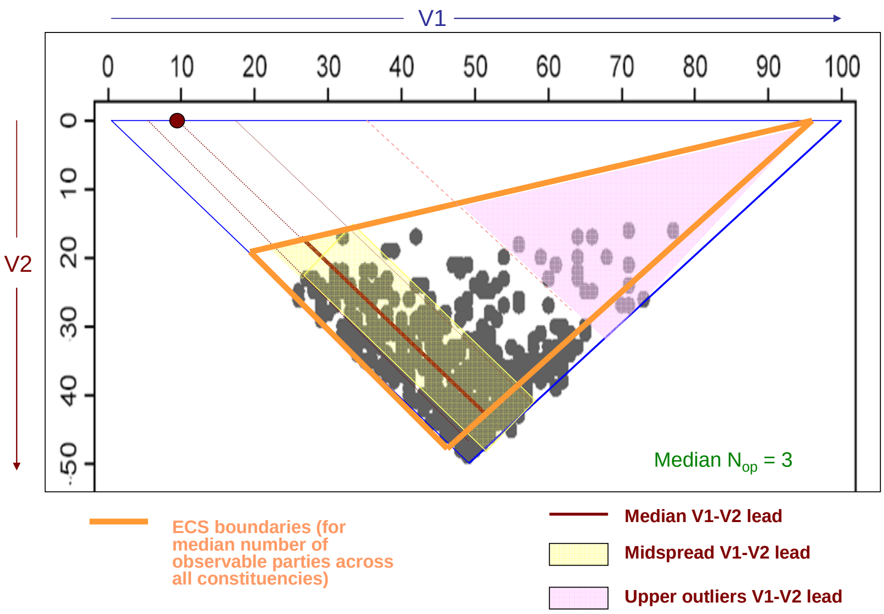
Values for largest party's lead over runner up:

1977	Q_L = 13.1	Median = 24.8	Q_U = 39.8	Upper outlier > 80.5
1984	Q_L = 8.9	Median = 17.9	Q_U = 29.4	Upper outlier > 61.5



1996 general election

2004 general election



<u>*Values for largest party's lead over runner up:*</u>

1996	Q_L = 5.0	Median = 9.4	Q_U = 16.9	Upper outlier > 35.0
2004	Q_L = 4.4	Median = 9.9	Q_U = 16.8	Upper outlier > 36.4

Figure 6: The proportion (%) of constituency outcomes falling within or outside the median ECS_2 area, in four Indian general elections from 1977 to 2004

In relation to the median ECS_2 area, the percentage of constituency outcomes	1977	1984	1996	2004
I falling above it	2.0	2.0	0.6	0.0
II falling within it	76.6	85.5	98.7	94.5
III falling below it	21.4	12.5	0.7	5.5

It is useful to segment the spatial distribution of outcomes in Figure 5 within and close to the ECS_2 area. The simplest approach is to look at the largest party's lead over the runner-up, shown as lines paralleling the A'B' boundary (parity of V_1 and V_2) placed at various distances towards C' (complete hegemony for V_1). Figure 7 shows four key lines:

- the median lead of V_1 over V_2, our key indicator of central level, whose line we extend up to horizontal axis to show a numeric value;
- the upper and lower quartiles, within which lies the midspread, the middle half of the data; and
- the upper outlier area, those outcomes where the largest party's lead is over 1.5 times more than the midspread above the upper quartile.

The resulting displays capture graphically some key features of any general election results distribution. For instance, we can see immediately that in India the median and midspreads for V_1-V_2 have sharply reduced in recent times, concentrating towards the A'B' boundary, but with a few straggling constituencies becoming upper outliers. Notice too that all the measures used here are relativized to each election. Where Grofman et al sought to compare results by allocating them across an abstract grid (much of it in fact necessarily empty), our grid of median, quartiles and outlier boundaries is always contextualized to a particular configuration but also yields immediately comparable data over time and across countries.

Categorizing results in terms of how they are distributed in the direction up from the B'C' line towards A' is a trickier task. One obvious measure to consider is the effective number of parties (ENP). At low levels of numbers of observable parties such as those here (3 to 5 parties) Figure 7 shows that it is a relatively simple matter to map ENP lines onto the ECS area. But we need to make a key simplifying assumption (introduced by Dunleavy and Hoijer, 2000), namely that the fragmentation of the V_3 to V_N vote conforms to one of the two conditions below:

- *Minimum fragmentation* means that as many V_{rest} parties as possible have a minimum feasible score (either 1 or more, depending on the situation) while V_3 and the immediately subsequent parties are as large as they could be, given these mimima and the size of V_2. For example, with the co-ordinates (40, 20, 40) for V_1, V_2 and V_{rest}, in a situation with 5 observable parties, the V_{rest} minimum fragmentation outcome is V_3 = 20, V_4 =19, V_5 = 1.
- *Maximum fragmentation* means that the total vote available across the V_{rest} parties is distributed as equally as possible between them. For example, with the same (40, 20, 40) co-ordinates (and N_{op} = 5) the V_{rest} maximum fragmentation outcome is V_3 = 14, V_4 =13, V_5 = 13.

The ENP lines under maximum fragmentation are relatively straight and they are (mostly) angled in ways that capture some of the distribution of results between A' and the B'C' line. However, under minimum fragmentation of V_{rest} the ENP lines curve towards C', creating for each of ENP lines shown an area where the ENP score can vary, depending on how precisely the V_{rest} aggregate vote share is allocated between these parties. This blurring effect becomes wider the greater the number of observable parties. With, say, 10 parties it does not make much sense to try and place

Figure 7: Mapping ENP scores for the Indian general election of 2004 onto the median ECS area

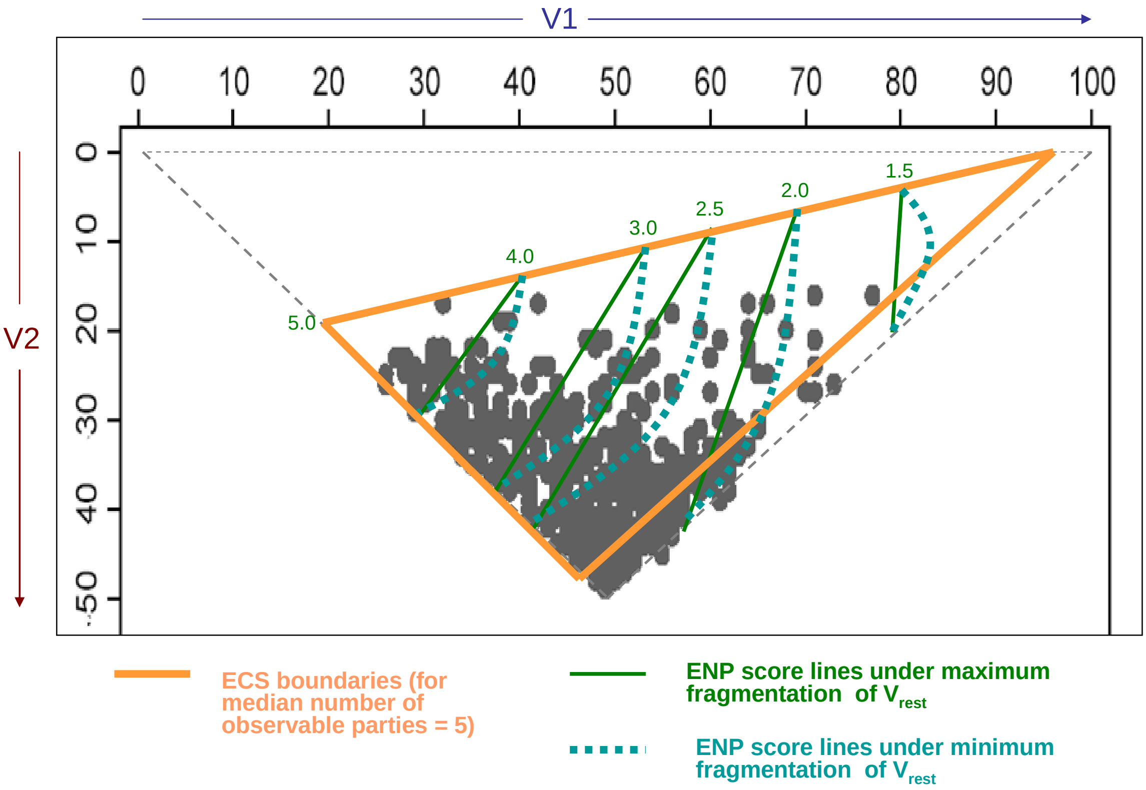


Figure 8: The combined ENP and largest party lead measures applied to constituency outcomes in the Indian general election of 2004

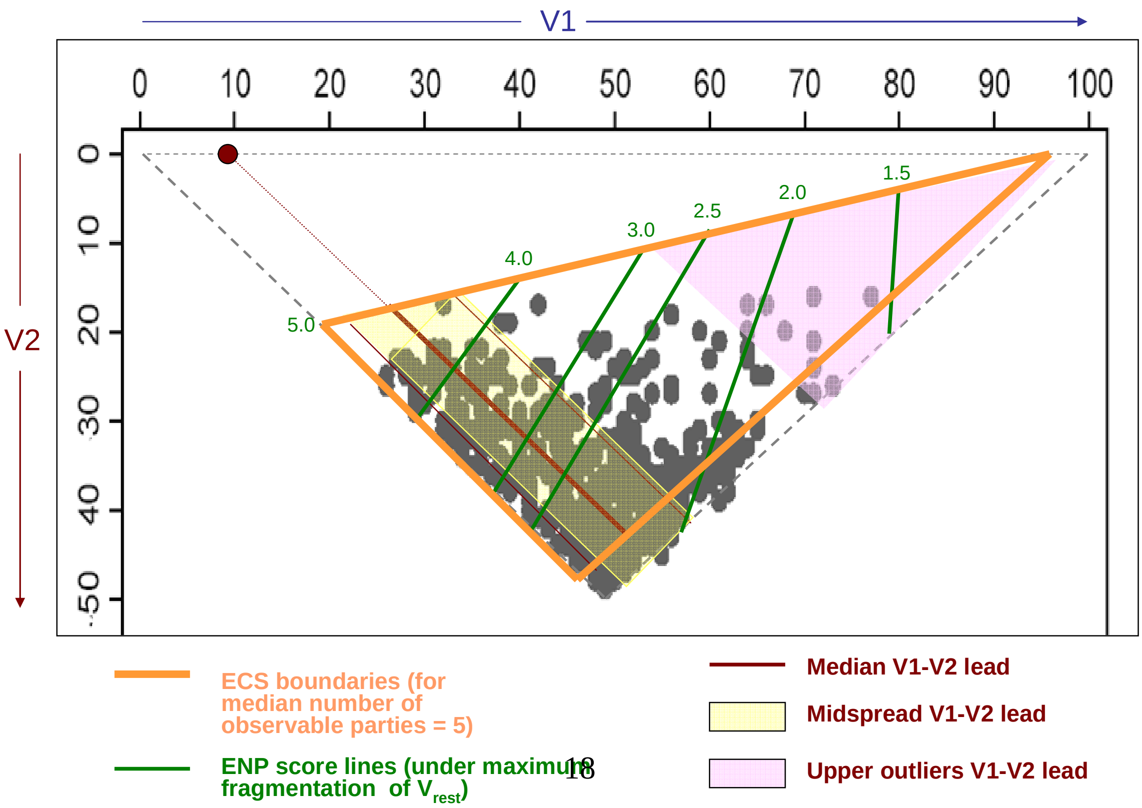


Figure 9: The proportion of all constituency outcomes in the 2004 Indian general election showing different levels of ENP and largest party lead over the runner up

Cell numbers show: the per cent of all Indian constituencies with different combinations of ENP scores and largest party's lead over the runner-up

	Largest party's lead over runner up					
Effective number of parties (ENP)	*Below Q_L (less than 4.4%)*	*Lower midspread (4.4 to 9.9%)*	*Higher midspread (9.9 to 16.6%)*	*Above Qu but not outliers (16.6 to 29.2%)*	*Upper Outliers (above 36.5%)*	**Total**
4.01 to 5	23.3	3.1	1.7	0.2	0.0	**8.3**
3.01 to 4	7.6	6.6	5.0	2.4	0.0	**20.1**
2.51 to 3	4.6	4.8	6.8	5.0	0.0	**21.2**
2.01 to 2.5	9.4	10.5	11.4	14.0	0.0	**45.3**
1.5 to 2	0.0	0.0	0.2	2.9	0.6	**3.7**
Total	*24.9*	*25.0*	*25.0*	*24.5*	*0.6*	**100.0**

Note: The median number of observable parties was 5.

ENP lines on the effective competition space, because the areas for a given ENP score overlap so extensively with that of its neighbours.

However, with a relatively low median number of observable parties across constituencies, as here, it can still be useful to cross-grid the largest party's lead with at least the ENP lines (for maximum fragmentation of V_{rest}) as we do in Figure 8. This display also lends itself to representation in table form, shown in Figure 9 for the 2004 general election. Yet because ENP scores can arise in multiple ways the apparent simplicity or precision of Figure 9 is deceptive (Dunleavy and Boucek, 2003). It is achieved by lumping together very different ENP situations which happen to generate the same number scores. Note also that this table form of presentation is still possible with many more parties (such as 10 or 11) when ENP boundary lines overlap so much as to make a graphical representation of them infeasible. This possibility may look convenient for reporting results synoptically, but is also potentially very misleading, unless the peculiarities and limitations of the ENP score itself are clearly borne in mind.

Thus the empirical application has shown that the theory expectations discussed in section 1 work out as predicted in the politically complex Indian empirical context. Looking at the median effective competition space, which in a two-dimensional view is driven solely by the number of observable parties, proves highly effective in framing the distribution of results in a much more appropriate and logically consistent way than the conventional triangle displays previously used. Looking at largest party leads, the ECS_2 area can also be easily segmented in a relativized way that allows analysts to easily generate genuinely useful and meaningful comparative data. Relating ENP boundaries to the ECS area is additionally useful when there are few observable parties, but ENP boundaries become first mushy and then disappear into a soup of different effects with higher N_{op} levels.

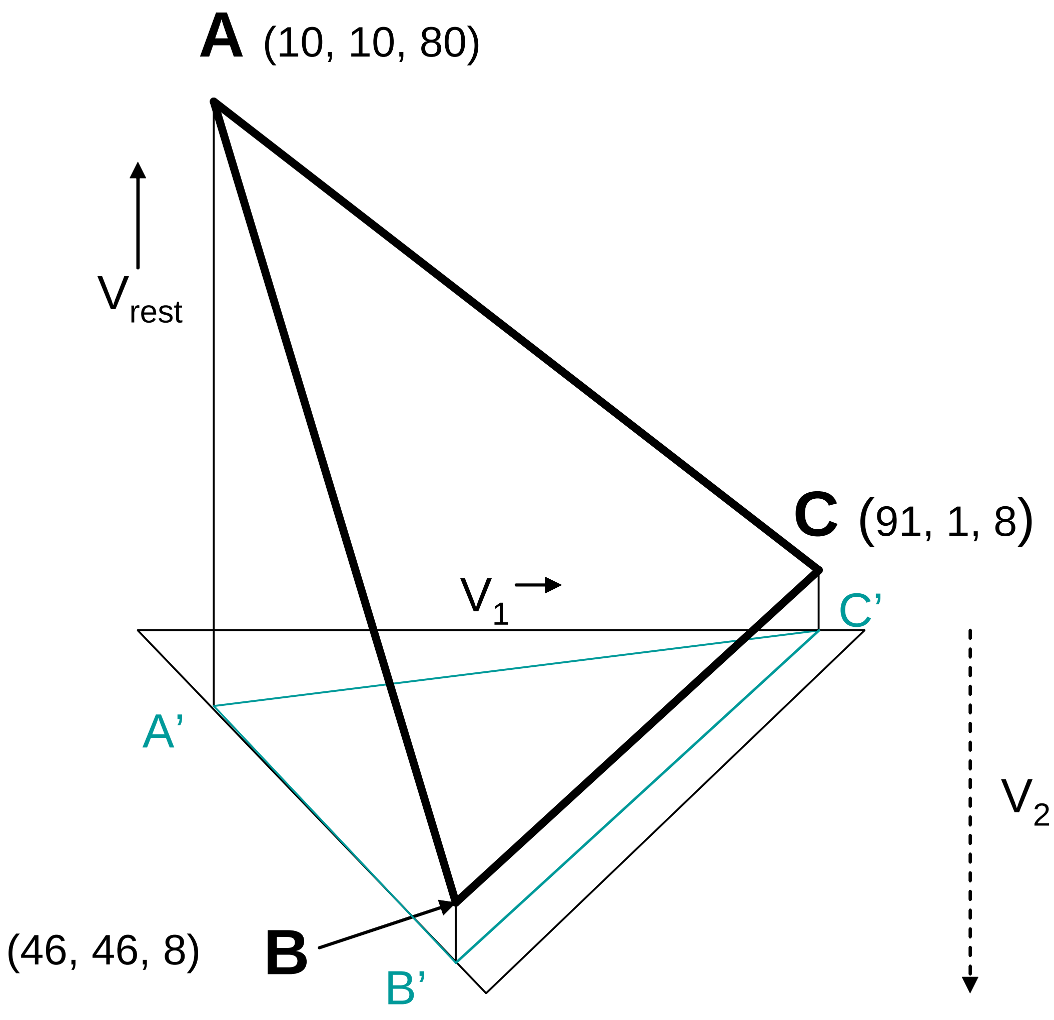
3. EFFECTIVE COMPETITION SPACE IN THREE OR MORE DIMENSIONS

The ECS_2 approach clearly entails a loss of some information and may generate misconceptions if analysts lose sight of how effective competition space works for all the parties, including the V*rest* combinations that are not shown. Hence before closing we briefly describe how other variants of the ECS concept operate, with more dimensions. We point to some insights they generate and some of the reasons why they are likely to be less applicable in electoral and party studies.

The three-dimensional version of effective competition space, ECS_3 shows co-ordinates for the top two parties and the total vote going to V_{rest}. ECS_3 is a more inclusive view because the 'opposition' vote as a whole is diagrammed. Treating V_{rest} as a single unit might be justified theoretically in some situations where voters first or most commonly try to assign their support between V_1 and V_2, and only if they cannot support them consider voting for alternative opposition parties - perhaps only on the rebound choosing whom to support within the V*rest* parties. Bélanger (2004) shows that what he terms 'anti-partyism' is an important phenomenon in plurality rule/alternative vote systems with strong top two parties in the UK, Canada and Australia. ECS_3 is also a view that can be easily analysed in an intuitive way and visually charted. Because V_{rest} can be defined as a residuum, this view also requires no more data to operationalize than ECS_2.

Figure 10 redraws the (N_{op} = 10) situation in Figure 2, this time including a third axis showing the V_{rest} vote share explicitly, graphed on an axis that rises upwards from the

Figure 10: A three-dimensional view of the effective space of competition (ECS_3) in an election with ten observable parties



page surface. The full space for party competition between V_1, V_2 and the many parties of V_{rest} can be visualized as a 3D plane, with the two right hand bottom points (B and C) starting at a 'plinth' height where V_3 to V_N have 1 per cent each. The plane surface here ABC is the operative space of competition including all information. The ECS_2 area discussed above is shown here as the flat surface area A'B'C' here. It can be understood as a projection downwards onto a horizontal surface of the more inclusive relationships captured in the ABC plane.

A key advantage of the 3D, plane view is that because it includes all party vote shares (at least in some form), it captures in a very clear way the considerable differences that exist in the mathematical probabilities of different results occurring. In the special case of a three-party situation, there are 50 slots along the BC axis where two-party dominance occurs and V_3 receives only 1 per cent, and only one slot at A where an absolutely equal multi-party outcome can occur. In an integer world, the ECS_3 display also shows that if voters do not treat the Vrest parties in a differentiated, 'first choice' way, then many more results should logically accrue in the bottom regions of the plane closer to the BC boundary with two major parties than can possibly occur close to A, with relatively equal vote shares across many parties. So, if outcomes were being generated randomly by computer for linked triple co-ordinates for V_1, V_2 and V_{rest} then there would be a strong inbuilt tendency for outcomes closer to BC to come up. This effect clearly varies with the number of observable parties, which reshapes the height and slope of the ABC plane and hence the number of slots available. The height of the V_{rest} maximum in Figure 10 ranges from 8 to 80 with ten parties. But with three parties the V_{rest} range is only from 1 to 34, for example, while with 50 observable parties the V_{rest} range is from 48 to 96.

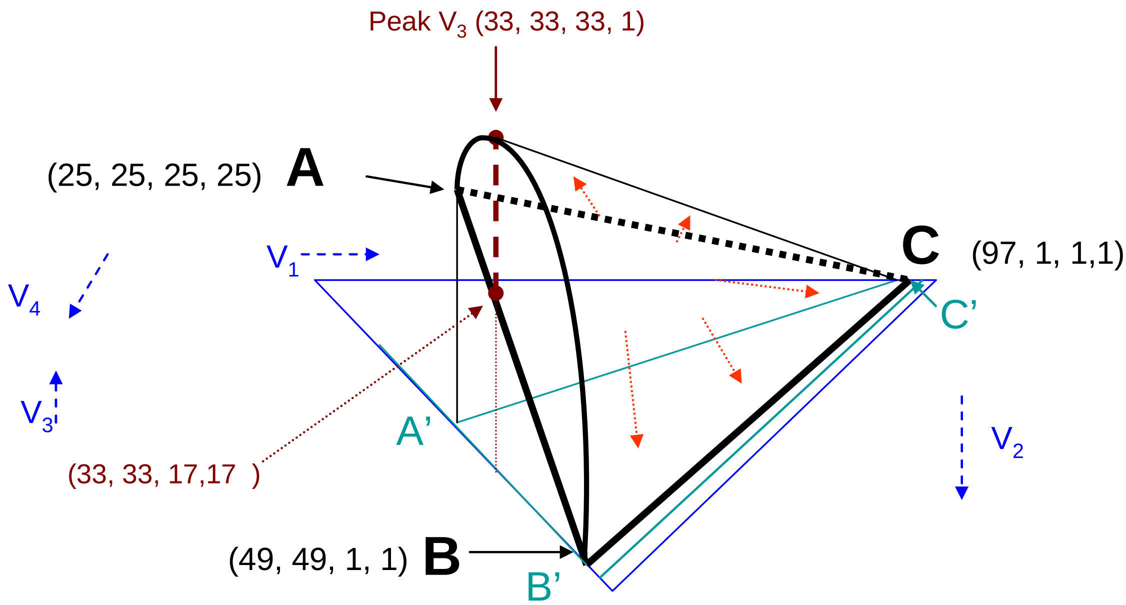
The multiple dimensions version of effective competition space (ECS_m) recognizes that even Figure 10 still hides a lot of information by aggregating together all the V_3 to V_N vote shares. By contrast ECS_m defines the effective competition space by paying attention to all the 'slots' available if people choose across *all* the observable parties in the same way, on their own merits. It treats all possible permutations of the V_{rest} parties' support as wholly independent outcomes, chosen directly and purposively by voters. This view assumes that any feasible configuration of V_1 to V_N outcomes is equi-probable, thereby taking a 'maximalist' view of the space of competition.

Despite its inclusiveness, ECS_m has some significant disadvantages because precise party scores for multiple parties cannot be easily depicted visually or even easily described in an intuitive way. It also requires a very high level of data accuracy in order to be operationalized, since the multiple ECS concept focuses on fixing the outcomes in a rank-structured sequence of parties, V_1 to V_N.[8] If necessary in empirical analysis ECS_m can be calculated with an error term U (for 'unobservable') that simply sweeps up and expresses as one number any support for very small parties falling below the ‘observable’ level.

There is a more crippling barrier to any practical use of the ECSm concept. Laver and Benoit (2005) have shown that as the number of observable parties increases so the number of non-exclusive distributions becomes computationally explosive. From the 834 available slots with three parties (in an integer world) the number of non-equivalent ways in which parties can ordered by voters grows to over 143,000 with 6 observable parties, and then escalates to more than 3.2 million combinations with just 10 observable parties. Beyond this level the number of combinations is hard to chart even with a powerful computer and sophisticated software. Theoretically the computationally explosive impacts of N_{op} growth on the number of choice dimensions makes it extremely implausible that most voters (or indeed any individual voter) can indeed treat all parties equally, choosing independently across each of them. In a polity like contemporary India, where the Nop levels often reach double figures the cognitive demands of doing so are infeasible.

For the special case when N_{oa} = 4 we can still (just) illustrate the scores for all the alternatives graphically, as in Figure 11. (We also exceptionally show separate co-ordinates for V3 and V4 here). The possible score combinations create a configuration that fits part of a dome shape to the ABC triangle, a configuration that for convenience we term a ‘tri-dome’. Note that here alone the third dimension (rising out of the page surface) shows just the V_3 outcome. Here A is the peak score for V_4 at 25, where all alternatives are equal. But V_3’s peak score is further along the top of the tri-dome surface linking ABC, along the top AB boundary, where the top three alternatives have just under a third of the vote each and V_4 has 1. As in previous diagrams, the number of possible scores for all alternatives is 1 along the whole of the AC and BC boundaries. But here in addition V_4’s score is in fact 1 running all along the top tri-dome surface connecting ABC, and its range is measured by the distance from this top surface *down* to the original ECS_3 plane. For instance, with V_1V_2 scores of 33 each, if we follow the brown line showing peak V_3 score down, then V_4

Figure 11: An illustrative view of the competition space when there are four observable alternatives



Note: In this diagram *only* the co-ordinates show V_1 to V_4 scores

does best when both V_3 and V_4 split the remainder evenly with 17 at the point shown. For any given combination of V_1 and V_2 scores, V_4's score reaches a maximum at the bottom plane surface connecting ABC. V_4's range is at its maximum in the mid point of the AB boundary.

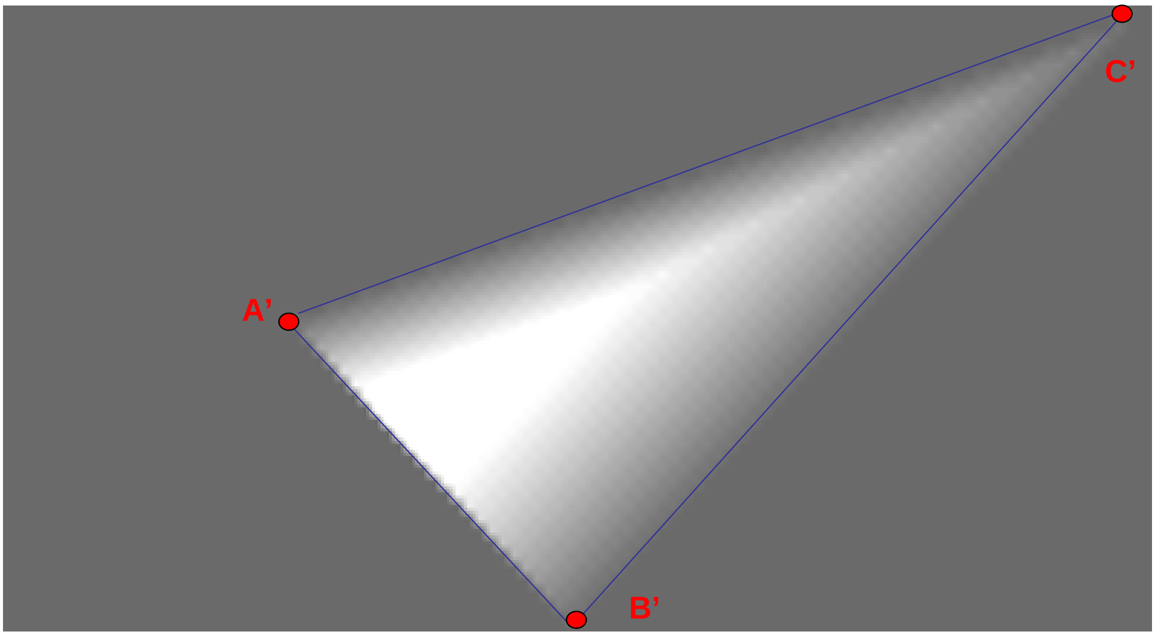
With five or more alternatives graphically representing the scores for alternatives is not feasible, but nor is there any very accessible way of algebraically defining them. Relatively simple computing algorithms can be used to derive them, but the resulting listings are voluminous. The most economical way of summarizing the structure of the outcome space is to compile density plots of the maximum number of outcomes across all V_{rest} alternatives that are logically possible with given V_1 and V_2 scores, mapped onto either the ECS_2 or ECS_3 views. In Figure 12 we choose the ECS_2 spaces for simplicity, and show density plots where the light-coloured space within the ECS triangle indicates the slots with the highest number of total vote combinations. The darkest shading inside the triangle shows the slots with fewest combination – falling to one possible combination in all the slots along the whole of the B'C' and A'C' boundaries. Figure 12a shows the tri-dome shape when the number of observable parties reaches 4. Figure 12b covers a situation with 8 observable parties: the area of highest combinations shrinks towards lightest area shown along the middle of A’B’ boundary. But of course the numbers of total vote-combinations for each V_1V_2 slot at first grow very rapidly as the number of parties grows, before falling again at high levels of N_{op} (beyond 20). With 8 observable parties the light shaded areas of Figure 12b have an enormous concentration of all possible outcomes and the resulting shape is heavily distorted by this enormous narrowing concentration of peak densities.

CONCLUSIONS

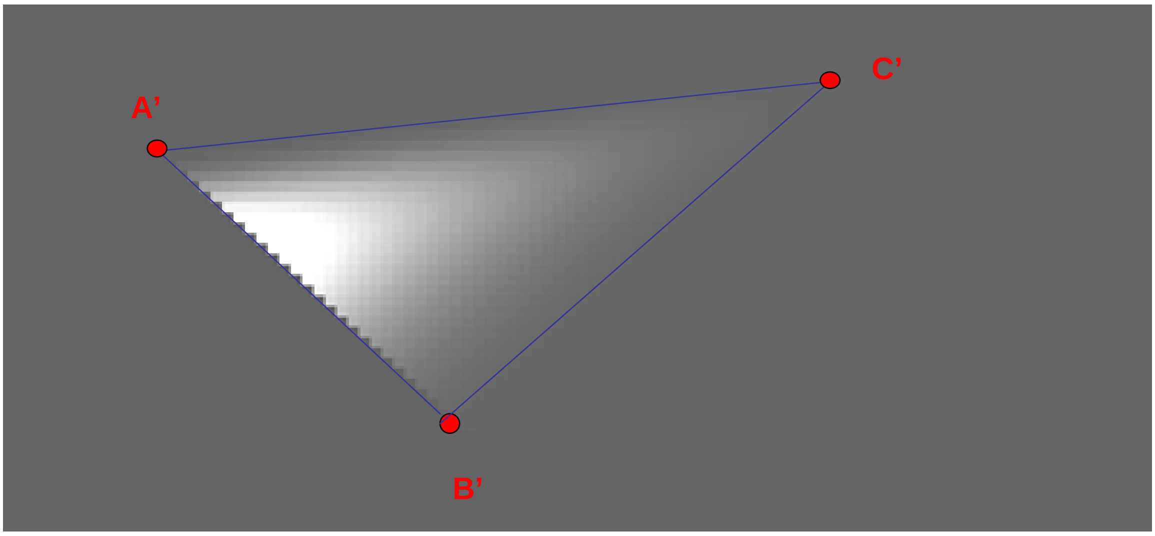
In this paper we have focused narrowly on the important goal of easily charting election outcomes in ways that are technically correct and meaningful. A two-dimensional version of the effective competition space concept corrects for some important misconceptions built into the conventional triangle displays previously used. Higher dimensional versions of effective competition space are feasible and may have applications in other contexts. But the lower-dimension (ECS_2 and ECS_3) versions of the concept will have most applicability in general election contexts. ECS provides an effective way of generating appropriately relativized data while facilitating valid and meaningful comparisons across elections. The approach shows the importance of appreciating that in most election situations both index scores and the logical/mathematical framework within which the scores themselves sit will change at the same time. Consequently the indices used in electoral analysis can never be thought of as creating some kind of abstract or unchanging grid across which radically different situations can be compared in a decontextualized manner. The ECS emphasis upon relativized indices is also consistent with the need to shift from ‘institutional’ to ‘experiential’ approaches to assessing voting behaviour and electoral competition effects (Dunleavy, 1996).

Figure 12: Density plots of the total numbers of possible vote combinations across V_1V_2 cells in the ECS_2 view

(a) Four observable parties



(b) Eight observable parties

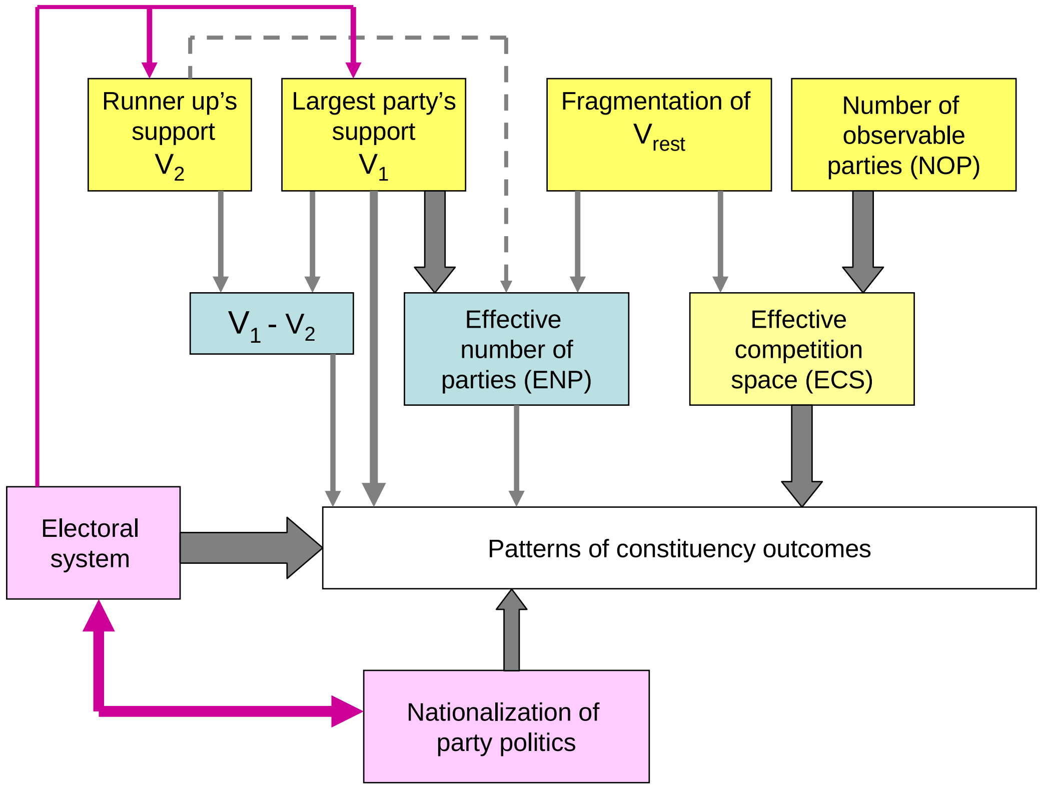


Key: Within the A'B;C: space, light shading indicates the area of greatest density of total vote combinations feasible, while progressively fewer combinations are shown by darker shading.

We conclude by highlighting the strong analytic and empirical importance of an unsung variable, the number of observable parties (N_{op}), in shaping how election outcome spaces are structured. To our knowledge N_{op} has never been accorded any strong significance in the previous literature. But especially at low levels of observable parties we have shown that this variable is very important in fixing the effective space of competition. Figure 13 shows a tentative model of the influences acting on the aggregate patterning of election outcomes, which makes clear the dominant (and independent) influence of N_{op} as a fundamental variable on the effective competition space. Exploring and quantifying the inter-relationships between the variables in Figure 13 is a substantial empirical agenda, in particular, to trace how changes in Nop levels occur across space and time within countries. But this research will be key to the conceptual integration of outcomes spaces in political competitions.

There are good reasons to believe that party fragmentation is a key *leitmotif* of modernization and democratic maturity across many countries (outside the clearly exceptional, perfect two-party system in the USA). It is clear that increasing party fragmentation has already had major empirical implications.[9] The diffusion and change processes by which initially integrated party systems with low N_{op} numbers change into much less integrated systems with increased N_{op} numbers remains to be systematically studied with the toolkit set out here. We need to know how political elites are encouraged to create or sustain initially small parties, that may be observable but are not initially viable contenders for power, often for long periods. If new studies show that N_{op} changes are empirically critical in this process, it could imply a strong need to shift research attention away from the past obsession with big parties and the (flawed) ENP approach to measurement associated with it. Instead we may need to investigate in a much more seriously engaged and sustained way the factors that have caused party fragmentation to gradually increase in many countries. A small amount of theoretical work has already highlighted the importance of understanding in detail the processes by which new parties come to form and to compete (Hug, 1996 and 2001; Dewan, 2007; Rabinowitz et al, 1991). Studying the patterning of effective competition space can make a useful contribution to how we understand both these specific changes and the wider processes structuring the vote shares of larger parties.

Figure 13: The main variables influencing the patterns of constituency outcomes in elections



Appendix 1: Two examples of misconstruing indices in comparative electoral research

(a) *The 'Rose 'Index of proportionality'*

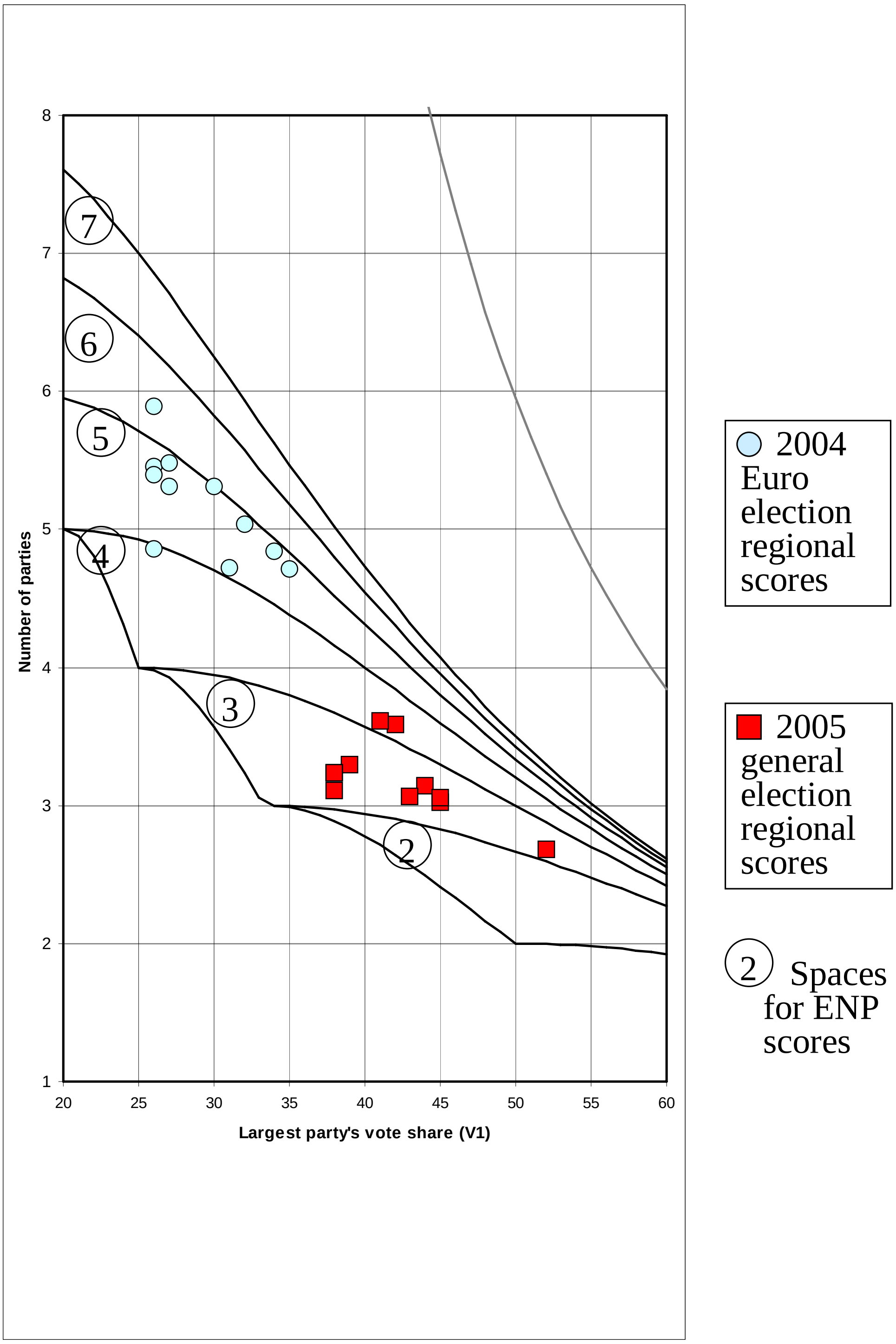
Early work in electoral studies saw some authors, notably Richard Rose (1974) offering an 'index of proportionality' calculated as 100% minus the Loosemore-Hanby *deviation from proportionality* (DV). Supposed to have a floor of zero this 100 - DV measure was claimed to offer a measure of how far a political system deviated from pure proportionality. This makes no sense, however, because a maximum DV score of 100 can only be attained by an electoral system that awards all available seats to a party that gets *no* votes at all. Therefore no conceivable liberal democratic election system could ever attain a score of 100. In fact, the practicable maximum score on the DV index is most often 100- V_1 for a completely mal-performing liberal democracy, where V_1 is the vote share of the largest party. In this case the minimum score on the 'Rose index' is in fact V_1 itself and not zero as Rose apparently believed. This alleged 'index' has now thankfully fallen out of use as this problem becomes better known to most analysts. Yet the 'index' is still sometimes republished (Rose, 2001) and those who place trust in it can be lead to publish erroneous scores of countries' performance based upon it. For instance, Norris (2004, pp. 91-3) incorrectly describes the Rose index as a 'standardized form' of DV and includes tables using it that credit countries with far higher levels of 'proportionality' than they are in fact able to claim.

(b) The effective number of parties (ENP)

ENP has also been seen by many authors as a simple index, and it is widely used in quantitative analyses on the implicit assumption that it operates in a linear fashion. In fact, ENP has complex mathematical properties, with the growth of scores 'slowing down' close to whole-number 'tether points' (like 2.0 or 3.0) under minimum party fragmentation and then 'speeding up' once they are past (Dunleavy and Bouceck, 2003). So feeding ENP scores into quantitative analyses risks confusing real and artefactual effects. And any given ENP score may arise in many different ways, depending on the size of V_1 and on the total number of parties with votes above a low threshold (like 1 per cent). A display of all the possible configurations shows a series of peculiar 'batwing' shapes that are in no respect simply intuitive (see Figure 14 below). The meaning of any particular ENP score varies systematically with V_1, so that the index should never be quoted without the largest party's vote share also being cited, and (ideally) without some graphical reference to where the observation points sit within the 'batwing' display. As an example of good practice, Figure 14 shows the scores for the regional ENP_V scores recorded in the regions of Great Britain at the 2004 European Parliament elections using list PR and the 2005 general election using plurality rule, set against the underlying 'batwing' shape for ENP scores (see Dunleavy and Margetts, 2005).

Finally, it is worth noting that some critics of ENP proposed alternative measures that are far worse in their mathematical properties. For instance, Molinar succeeded in constructing an alternative index which bears no obvious relationship to the phenomena it is designed to measure and which behaves in such a mathematically odd way that it should never be used in any circumstances (see Dunleavy and Bouceck, 2003, Annex 1). Yet again this index is still often calculated by authors who almost certainly are unaware of its highly unusual properties.

Figure 14: An example of how to compare ENP scores appropriately
(in this case, regional ENP scores at two UK elections, the 2004 European Parliament using list PR and the 2005 general election using plurality rule)



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FOOTNOTES

[1] Of course, as more parties enter the system the maximum vote share for the smallest party in the system is 100 per cent divided by the number of parties. This limit shrinks, albeit at a slower and slower rate, to 33.3 per cent for V_3 with three parties, 25 per cent for V_4 with 4 parties, 20 per cent for V_5 with five parties, 16.7 per cent for V_6 with six parties, and so on.

[2] For applications see Likhtenhctein and Yarmgomskaya (2005) and Diwakar (2006).

[3] We recommend as good practice showing the V_{rest} co-ordinate in the ECS_2 plots in order not to forget about these other parties, even though V_{rest} support is not shown explicitly.

[4] This also assumes that each observable parties gets at least 1% of the total votes. The formula used to calculate area of triangles given the x and y co-ordinates is abs((xB*yA-xA*yB)+(xC*yB-xB*yC)+(xA*yC-xC*yA))/2

[5] For Anglo-American electoral analysts even envisaging a party system with an N_{op} of 50 may seem fanciful, but there are far more parties in the Indian political system, as we show below. Even a legislature like the Westminster House of Commons, elected by one of the most constraining and least proportional voting systems in the world, currently (2007) has 15 different parties represented. In the UK's 2005 general election (using plurality rule) at least six parties met the N_{op} criterion of 1 per cent in every region of the country, and even more for 2004 proportional elections (Dunleavy and Margetts, 2005, p. 857-8). The number of parties 'bubbling under' the 1 per cent level in the UK is also large. So (outside the USA) we need to take perfectly seriously the possibility of there being between 20 and 50 observable parties in even the most restrictive political systems.

[6] Some readers may feel that the restriction of 'observable' parties to a 1 per cent minimum is artificial and that with smaller party sizes (such as we observe in 'real life' situations) the problems set out above would not occur. The objection is easily turned around. With small parties or candidates below 1 per cent vote share, simply aggregate them together into a residual term (U) showing the total vote share of 'unobservable' parties. This procedure is useful in comparative work because it is almost impossible to pull together any reliable information on the vote shares of parties this small. (Indeed even to find vote shares accurate down to 1 per cent within a single country may be an onerous task when working from most published sources).

Creating this U term slightly re-positions the right hand boundary equation to V2 = 100 – (N-2) – U. The top and left hand boundaries shown in Figure 3 will still be as in our account above.

[7] For additional background, see Diwakar (2006).

[8] Of course, it does not matter for our purposes which particular party is ranked where. ECS_m looks at all possible *patterns* of party vote shares across observable parties, but not at multiple ways of allocating the same pattern across different competing parties.

[9] Some key areas have been in the comparative study of liberal democracies, where Harmel and Robertson (1985) found 233 new parties were formed across 19 advanced liberal democracies between 1960 and 1980; for post-transition eastern European political systems, where volatility has been high (Sikk, 2005; Szajkowski, 1994) and outside actors have intervened to fund new parties (Glenn, 2000); for the study of British politics (Dunleavy, 2005); for Indian politics (Diwakar, 2006 and 2007); and for understanding intra-party politics and dominant party systems (Boucek, 1998 and 2003).