Racial Gerrymandering and Minority Representation

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Question: How to design institutions that afford political minorities policy benefits?

- Stable political systems require that all major groups “buy in,” see outcomes as legitimate.
- Otherwise, result is oppression and/or violence, loss of productive resources.
- Analogy: the protection of minority investors as a key component of smoothly working capital markets.

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Institutions from the Minority’s Point of View

- In a majoritarian system, political minorities must form coalitions to exert influence over policy.
- These coalitions can be made at the electoral or legislative stages.
- Institutions can favor one type of coalition formation over the other; this may involve tradeoffs.
  - Consociational Democracy
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- Georgia was controlled by Democrats, spread black voters out across districts for a partisan gerrymander.

- Question was whether Georgia’s State Senate redistricting plan was “retrogressive” under §5 of the VRA.
  - This section requires Southern states to pre-clear new laws that might affect minorities’ voting rights.

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Protecting Minorities: The Big View

Electoral Rules → Party System → Platforms

Elections → Legislature → Policy
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- Theory on partisan redistricting: Owen and Grofman 1988; Cox and Katz 1999; Gilligan and Matsusaka 1999
- Empirical literature on racial redistricting: Cameron, Epstein & O’Halloran 1994; Lublin 1997; Epstein and O’Halloran 2000
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1. Single policy dimension, minority group is extreme
2. Competing gerrymanderers in each state
3. Majority-minority mandate can only move policy in liberal (minority-preferred) direction
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Our Take on the Problem

- We want to capture a possible tradeoff between coalition formation at the electoral and legislative stages.

- We therefore want our model to include:
  1. Both electoral and legislative stages, with strategic platforms and far-sighted voting
  2. Multidimensional setting, for coalition formation at each stage of the process
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Groups $\Theta = \{BD, WD, R\}$ to be split across $K$ districts

Statewide populations $N_{BD}$, $N_{WD}$, and $N_{R}$

Then the districting matrix will look like:

$$
\begin{pmatrix}
WD_1 & BD_1 & R_1 \\
WD_2 & BD_2 & R_2 \\
\vdots & \vdots & \vdots \\
WD_K & BD_K & R_K
\end{pmatrix}
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Triangles: Districting Made Simple(x)

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Simplex Representation

Can represent the problem as a set of points in the two-dimensional simplex $S^2$:
Simplex Representation

Then districts have to average to the overall statewide proportions:
Elections

First, WD and BD candidate run in a primary, with the winner facing the R candidate. Assumptions:

1. No BD or R crossover;
2. In the primary, a fraction $a$ of WD voters cross over to cast their ballots for the BD candidate, with $0 \leq a \leq \frac{1}{2}$;
3. In a BD vs. R general, a fraction $b$ of WD voters cast their ballots for the BD candidate, with $a \leq b \leq 1$; and
4. In a BD vs. WD general election, a fraction $c$ of WD voters cast their ballots for the WD candidate, with $b \leq c \leq 1$. 

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Elections

The BD candidate will win the primary if

\[ N_{BD} \geq (1 - 2a) N_{WD}. \]
Elections

The BD candidate will go on to win the general if:

\[ N_{BD} + b N_{WD} \geq 1/2. \]
Elections

Overall, the winners in each region are:
Some Preliminary Results

Increasing the number of black democrats, keeping the ratio of white democrats and republicans constant:
Some Preliminary Results

Replacing white democrats with republicans, keeping the ratio of black democrats constant:

![Diagram showing the relationship between white democrats (WD), black democrats (BD), and republicans (R), with a constant N_{BD}.]
Model: Groups and Districts

- Voter types $\Theta = \{BD, WD, R\}$, with statewide populations $N_{BD}, N_{WD},$ and $N_{R}$.

- A district is a vector $d = (N_{BD}, N_{WD}, N_{R})$ of voters, with $D$ the set of all possible districts.

- Then a valid districting scheme is a function $D : S^2 \rightarrow D^K$ such that in any given district, $\sum_i N_{ik} = N/K$, and across districts $\sum_k N_{ik} = N_i$. 
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Candidates and Elections

- Three candidates in each district, BD, WD, & R, with a BD vs. WD primary, winner against R.
- Candidate $j$ in district $k$ adopts platform offering proportion $T_{ijk}$ of the district's redistributive benefits to group $i$, $\sum_i T_{ijk} = 1$.
- These can be thought of as promises to different groups for a certain share of the legislative pie:
  - Effort across different issue areas
  - Staff positions, campaign workers
  - Type and location of pork barrel projects
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Candidates and Elections

- A candidate is a vector $c = (\theta, T_{BD}, T_{WD}, T_R)$; let $C$ be the set of all possible candidates.
- An election is a mapping $L : D^K \times C^3 \rightarrow C^K$.
- Voters are farsighted: they vote for the candidate who will give greatest expected utility, given voting strategies in all other districts.
- Assume probabilistic voting to smooth out response curves, so that the probability type $j$ wins, $\Psi_j$, is equal to their vote share.
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Legislature and Policy Outcomes

- The winners of the $K$ district elections then go to a legislature $L \in C^K$, so that $L = L(D(S^2))$.
- They have $K$ dollars to divide across districts, which they do via (open rule) legislative bargaining.
- Yields a vector $(B_1, B_2, \ldots, B_K)$ of district-specific benefits, with $B_k \geq 0$ and $\sum_k B_k \leq K$. 
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Legislature and Policy Outcomes

- Voters in group \( i \) of district \( k \), with representative type \( j \), will receive \( T_{ijk} \times B_k \) in total benefits.

- Individual benefits are then \( b_{ij} = (T_{ijk} \times B_k) / N_{ik} \).

- Policy is \( P : C^K \rightarrow \mathbb{R}_+^K \), so \( P = P(L(D(S^2))) \).
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Voters

- Each voter receives utility $U(\cdot)$ from redistribution, and ideological benefit $X^j$ for a candidate of type $j$.

- The voter will therefore prefer candidate 1 over 2 if:

$$E[U_i(b_{i1})] - E[U_i(b_{i2})] > X^2 - X^1.$$

- Define the cutpoint $X_i$ for group $i$ in an election between candidates of types 1 and 2 by:

$$X_i^e = U_i(b_{i1}) - U_i(b_{i2}).$$
Voters

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$$E[U_i(b_{i1})] - E[U_i(b_{i2})] > X^2 - X^1.$$

- Define the cutpoint $X_i$ for group $i$ in an election between candidates of types 1 and 2 by:

$$X_i^e = U_i(b_{i1}) - U_i(b_{i2}).$$
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Let $\Phi^e_i(X) \text{ be the cumulative distribution of voters of group } i \text{ in an election of type } e$.  

Then candidate 1 will get votes:

$$V^e_1 = \sum_{i \in \Theta} N_i \Phi^e_i(X_i).$$

Similarly, the opposing candidate will get votes:

$$V^e_2 = \sum_{i \in \Theta} N_i [1 - \Phi^e_i(X_i)] = \sum_{i \in \Theta} N_i - V^e_1.$$
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- Utility from consumption is given by:

  \[ U_i(b) = \kappa_i b^{1 - \epsilon} \frac{1}{1 - \epsilon} \]

- Then the marginal utility of an extra dollar of consumption is

  \[ U'_i(b) = \kappa_i (b^{-\epsilon}) \]

- A one percent increase in \( b \) causes an \( \epsilon \) percent decrease in marginal utility.

- Furthermore, \( \kappa \) captures the tradeoff between ideological and consumption benefits.
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The Social Planner’s Problem

- Evaluate districting plans according to their impact on minority voters, assuming that a social planner wishes to maximize minority voters’ overall welfare.

- Then the social planner selects:

\[ D^* \in \arg\max_{D \in \mathcal{D}^K} \sum_{i=1}^{N_{BD}} X_{i}\theta[L_k(D)] + E[U_i(b_i) \mid P(L(D))]. \]
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Equilibrium: Bargaining Game

- Say legislator $l$ is selected; she forms a random coalition $C$ of others, remainder $D$ excluded. Then:

$$B_k = \begin{cases} 
\frac{(2-\delta)K-\delta}{2} & \text{if } k = l; \\
\delta & \text{if } k \in C; \\
0 & \text{if } k \in D.
\end{cases}$$

- Each legislator has expected return of 1 from this game.
- Means that platforms are expected values for each group.
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- Each candidate offers group $i$

\[ T_{ij} = \frac{N_i \pi_i}{\sum_j N_j \pi_j}, \]

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Analysis: Maximizing Distributive Benefits

Note that \( N_{BD} + N_{WD} + N_R = P \), and rewrite the share function as:

\[
f (N_{BD}, N_{WD}) = \frac{\pi_{BD}N_{BD}}{(\pi_{BD} - \pi_R)N_{BD} + (\pi_{WD} - \pi_R)N_{WD} + P\pi_R}.
\]

Then

\[
\frac{\partial f}{\partial N_{BD}} = \frac{\pi_{BD}[\pi_R(P - N_{WD}) + \pi_{WD}N_{WD}]}{\Sigma^2} > 0
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\frac{\partial f}{\partial N_{WD}} = \frac{\pi_{BD}N_{BD}(\pi_R - \pi_{WD})}{\Sigma^2}.
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Proposition

If $N_{BDi} \neq N_{BDj}, \forall d_i, d_j \in \tilde{D}^*, i \neq j$, then at most one $d \in \tilde{D}^*$ is interior to $S^2$. 

![Diagram of a triangle with points labeled R, a, b, WD, and BD.]
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Maximizing Distributive Benefits

The problem in maximizing comes with the Hessian, which isn’t always positive or negative definite. This means that the surface can be concave or convex.
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Examine the line connecting any given point in $S^2$ to (0,1,0), keeping the ratio of WD to R voters constant. Yields a parameterized path

$$g(t) = \frac{\pi_{BD}t}{\pi_{BD}t + \pi_{WD}\alpha(1-t) + \pi_{R}(1-\alpha)(1-t)}.$$ 

Then

$$g''(t) = -\frac{2\pi_{BD}[\pi_{BD} - \alpha\pi_{WD} - (1-\alpha)\pi_{R}]}{\Lambda^3[\alpha\pi_{WD} + (1-\alpha)\pi_{R}]^{-1}}.$$ 

This is negative if $\pi_{BD} > \alpha\pi_{WD} + (1-\alpha)\pi_{R}$, so surface becomes concave as minority power increases.
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If $\pi_{BD} = \max_{\theta \in \Theta} \{\pi_\theta\}$, then $T_{ij}$ is concave on $S^2$; if $\pi_{BD} = \min_{\theta \in \Theta} \{\pi_\theta\}$, then $T_{ij}$ is convex.

This means that as minority groups gain power, districting schemes that maximize their distributive benefits spread them out more evenly across districts.

And whenever possible, combine minority voters with voters from the less powerful non-minority group.
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Ideological Utility

First, see how districting schemes affect $\Psi_{BD}$, the probability of electing a minority candidate to office:

Proposition

1. $\frac{\partial \Psi_{BD}}{\partial N_{BD}} > 0$, so increasing the number of black democrats in a district always increases the probability of electing a black democrat.

2. The sign of $\frac{\partial \Psi_{BD}}{\partial N_{WD}}$ is indeterminate, so substituting white democrats for republicans can increase or decrease the chances of electing a black democrat.

3. At low levels of crossover voting, $\Psi_{BD}$ is convex on $S^2$. 
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David Epstein, Sharyn O’Halloran

Racial Gerrymandering and Minority Representation
Overall Ideological Utility

Define the average utility per voter of a given type $i$ for a $j$ type representative:

$$\bar{X}_i^j = \int_{-\infty}^{\infty} X_i^j d[\Phi(X_i)].$$

Overall expected utility for minority voters includes both the type elected and their average attachment to representatives of that type:

$$E(X) = \Psi_{BD} \ast \bar{X}_{BD} + \Psi_{WD} \ast \bar{X}_{BD} + \Psi_R \ast \bar{X}_{BD} = \Psi_{BD} + \beta \Psi_{WD}.$$
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Overall Ideological Utility

What can we say about the overall shape of $E(X)$?

Proposition

There exists $\hat{\beta} > 0$ such that $\beta < \hat{\beta} \Rightarrow E(X)$ is convex on $S^2$.

So when minority voters’ overriding concern is to elect minorities to office, concentrate voters in a few districts.

When the key is to avoid electing Republicans, spread them out more.
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Optimal Districting Schemes

How to maximize overall utility?
Optimal Districting Schemes

- How do the two elements discussed above—distributive and ideological utility—combine?
- In particular, is it still true that as minorities gain power, optimal districting schemes spread them out less?
- Key to the solution is that the two effects are linked:
  - Greater crossover results from a shift in the distribution of a group's $X_i$ values.
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Optimal Districting Schemes

Recall that $\pi_i = [\kappa_i \phi_i(0)]^{1/\epsilon}$, so there are two ways a group’s power can increase:

1. The group becomes more pivotal ($\phi_i(0)$ increases)
   - Then voters cross over to vote for more non-minority candidates.
   - This is equivalent to an increase in $\beta$.
   - So the ideological utility function becomes more concave.
Optimal Districting Schemes

Recall that $\pi_i = [\kappa_i \phi_i(0)]^{1/\epsilon}$, so there are two ways a group’s power can increase:

1. The group becomes more pivotal ($\phi_i(0)$ increases)
2. The group cares more about distributive as opposed to ideological benefits ($\kappa_i$ increases)

- Then the relative weight on distributive benefits increases.
- So as this becomes more concave, the overall utility function becomes more concave as well.
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Either way, the end result is that increased group power means optimal schemes spread minority voters out more across districts.

QED!
Application: Increasing Minority Voters

- The biggest impact of the VRA was to increase black participation in Southern politics.
- Led many conservative Southern Democrats (Thurmond, Wallace) to court the black vote through services and pork.
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Rising Republicanism

- The former “Solid South” Democratic party split, with the conservative wing becoming Republicans.
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Changes in Ideological Attachments

- White democrats more willing to vote for black candidates.
  - Makes it easier to elect blacks to office
  - But makes white voters more pivotal
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Epilogue

Supreme Court ruled in favor of Georgia in its redistricting case

- Said that legislators could maximize substantive, as opposed to descriptive representation.
- So retrogression must be defined in relation to both these modes of representation.
- In accordance with theory presented here: as minorities gain power, they prefer to spread their voters more evenly across districts.
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Sets up interesting questions for upcoming VRA §5 renewal.