

# “Gerrymandering in the Laboratory”

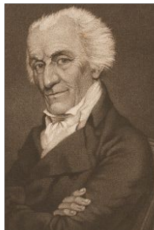
SunAh An    Buddy Anderson    Cary Deck

The University of Alabama

EC698 November 15, 2021

# What is gerrymandering?

- ▶ The manipulation of the boundaries of electoral constituencies to favor one election outcome over another
- ▶ Etymology began in 1812 when Massachusetts Governor Elbridge Gerry, signed a bill redrawing state senate districts

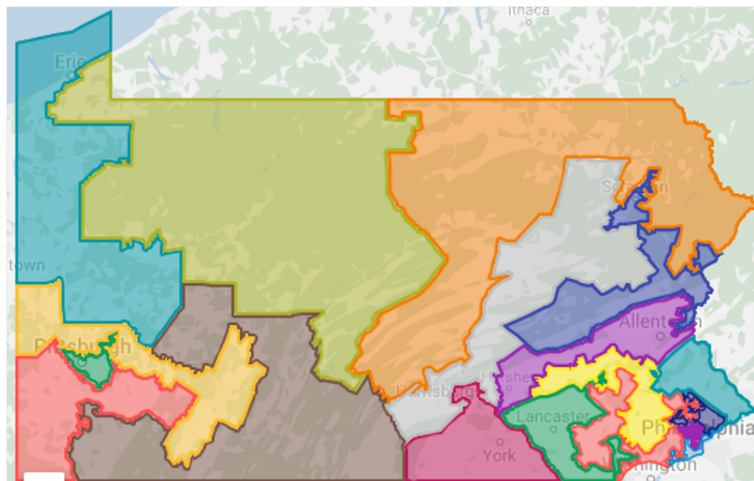


Elbridge Gerry



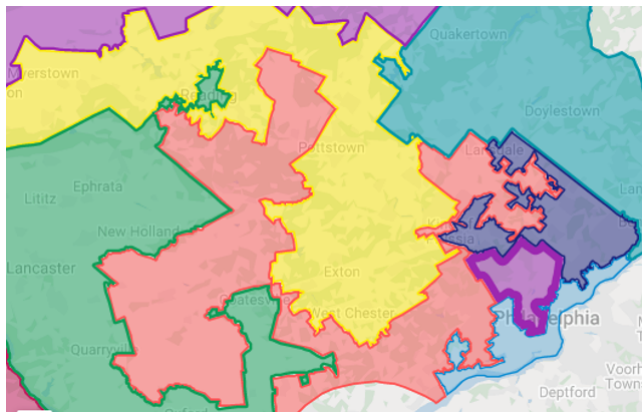
Gerry's Salamander

# Examples of Gerrymandering



Pennsylvania's 18 Congressional Districts

# Examples of Gerrymandering



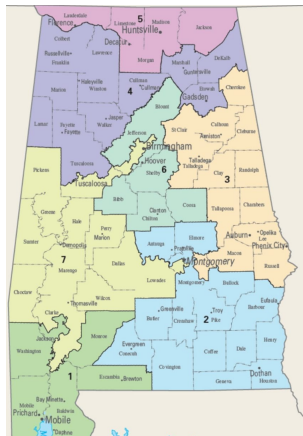
Pennsylvania's 7<sup>th</sup>: Goofy kicking Donald

# Alabama Congressional Districts

AL is 25% African-American



AL Representatives



AL Districts

# Literature Review

- ▶ Optimal Gerrymandering
  - ▶ Two types of voters (Owen and Grofman 1988)
  - ▶ Continuum of perfectly observable types (Gilligan and Matsusaka 1999)
  - ▶ Imperfectly observable types (Friedman and Holden 2008; Gul and Pseendorfer 2010; Kolotilin and Wolitzky 2020)
- ▶ Implications of Gerrymandering
  - ▶ Majority minority districts (Cameron, Epstein and O'Halloran 1996; Grigg and Katz 2005)
  - ▶ Participation (Hayes and McKee 2009)
  - ▶ Policy choice (Shots 20002; Besley and Preston 2007)
  - ▶ Polarization (McCarty, Pool, and Rosenthal 2009)

# Our Contest Map

- ▶ A Map consists of 3 Districts that each contain 3 Zones
- ▶ Players A and B compete for a prize of  $V$  by choosing effort expenditures, or bids, for each District
- ▶ To win a District a player must win a majority of the Zones in that District
- ▶ To win the contest a player must win the majority of the Districts
- ▶ Zones are either predetermined or competitive
- ▶ Competitions at the Zone level are determined by Tullock Contests based on District expenditure

# Our Contest Map

A	A	
A		B
	B	B

- ▶ There are 3 predetermined Zones for each player
- ▶ Districts are referenced by their color: White, Light Gray, and Dark Gray
- ▶ Maps are either (Gerry)mandered or (Symm)etric

A	A	
A		B
	B	B

*Gerry<sub>B</sub>*

A	A	
A		B
	B	B

*Symm<sub>1,1</sub>*

A	A	
A		B
	B	B

*Symm<sub>1,3</sub>*

A	A	
A		B
	B	B

*Symm<sub>3,1</sub>*

A	A	
A		B
	B	B

*Gerry<sub>A</sub>*



# Theoretical Predictions

- ▶ Player  $i$ 's expected payoff is  $E\pi_i = \rho_i V - \sum_d e_{i,d|M}$  for
  - ▶ the probability  $\rho_i$  that player  $i$  wins the Map and
  - ▶ the expenditure  $e_{i,d|M}$  of player  $i$  in district  $d$  on the given Map  $M$

A	A	
A		B
	B	B

$Symm_{1,1}$

- ▶ Player A wins District L  
 $\Rightarrow e_{A,L}^* = e_{B,L}^* = 0$
- ▶ Player B wins District G  
 $\Rightarrow e_{A,G}^* = e_{B,G}^* = 0$
- ▶ The winner of District W wins the contest
- ▶ Standard Tullock Contest for lone, unclaimed Zone in White District
  - ▶  $E\pi_i = \frac{e_{i,W}}{e_{i,W} + e_{j,W}} V - e_{i,W}$  for  $j \neq i$
  - ▶  $e_{A,W}^* = e_{B,W}^* = \frac{V}{4}$  and  $\rho_i = 50\%$

# Theoretical Predictions

Table: Summary of theoretic predictions

Map	District	$e_{A M}^*$	$e_{B M}^*$	$\rho_A$	$\rho_B$
$Symm_{1,1}$	W	$\frac{1}{4}V$	$\frac{1}{4}V$	$\frac{1}{2}$	$\frac{1}{2}$
$Symm_{1,3}$	W	$\frac{3}{8}V$	$\frac{3}{8}V$	$\frac{1}{2}$	$\frac{1}{2}$
$Symm_{3,1}$	W, L, and G	$\frac{1}{8}V$	$\frac{1}{8}V$	$\frac{1}{2}$	$\frac{1}{2}$
$Gerry_A$	W	$\frac{1}{4}V$	$\frac{1}{4}V$	$\frac{3}{4}$	$\frac{1}{4}$
$Gerry_B$	W	$\frac{1}{4}V$	$\frac{1}{4}V$	$\frac{1}{4}$	$\frac{3}{4}$

# Experimental Design

- ▶ Map varied within subject
- ▶ 8 sessions (8 subjects per session)
- ▶ Sessions progress in 3 Stages

Stage 1: 10 periods selecting only effort bids

Stage 2: 3 periods selecting preferred map and effort bids

Stage 3: 1 period selecting preferred map prior to role and effort bids assignment

- ▶ One period selected at random for payment
- ▶ Prize value  $V = 80$
- ▶ Exchange rate of 4 \$Lab = 1 \$US
- ▶ Programmed in Ztree (Fischbacher 2007)
- ▶ Conducted at TIDE Lab with \$5 participation payment

# Experimental Design

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Figure: Effort selection for each Map

# Experimental Design

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Figure: Information provided at the end of each period

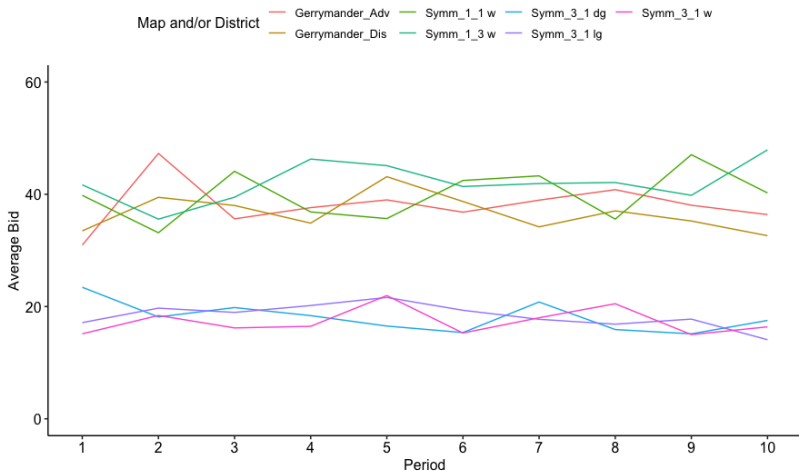
# Bidding Behavior Relative to Theory

Table: Equilibrium vs Observed Bids

Map	District	Equilibrium	Observed
$Symm_{1,1}$	W	20	40.2
$Symm_{1,3}$	W	30	43.4
$Symm_{3,1}$	W, L, and G	10	17.6
Gerry Advantaged	W	20	39.2
Gerry Disadvantaged	W	20	36.3

Players A and B do not exhibit different bidding behavior We analyze the gerrymandered maps in the context of advantages and disadvantages

# Treatment of Map



Average bid in competitive districts over Stage 1

# Treatment of Map

**Table:** Effect of Map Configuration on Total Bid in Stage 1

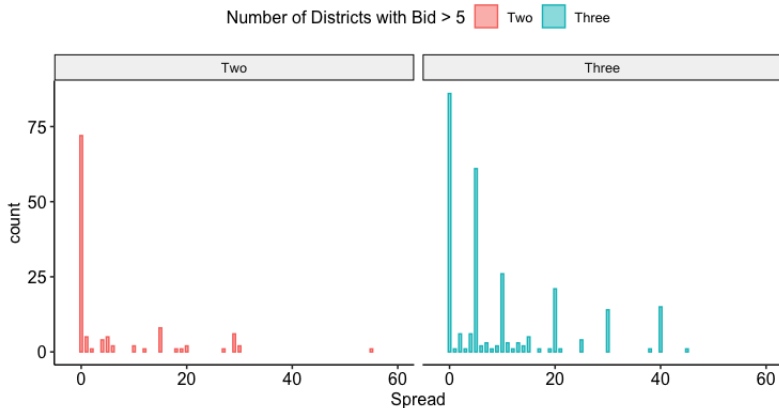
	Effort
Adv	-1.470 (1.207)
Disadv	-3.656*** (1.207)
Symm_1_3	1.417 (1.207)
Symm_3_1	7.189*** (1.207)
Constant	47.400*** (0.853)
Observations	3,200
R <sup>2</sup>	0.028
Residual Std. Error	21.588 (df = 3195)

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01



# Explaining *Symmetric*<sub>3,1</sub>

Number of Districts	Bids
0	9.2%
1	5.2%
2	24.3%
3	61.3%



# Thoughts on Gerrymandering?

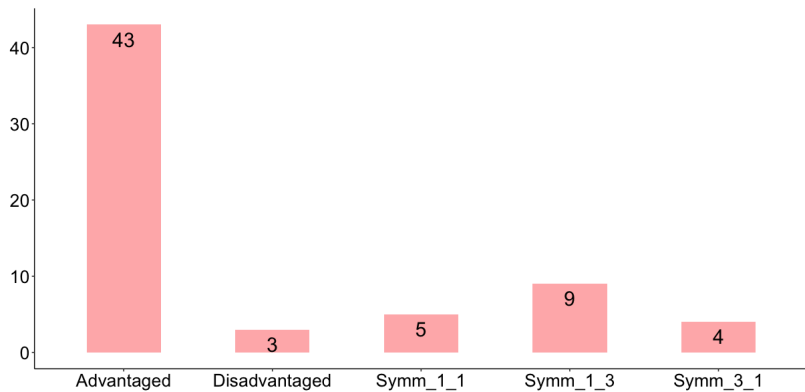
Subjects were asked:

*Do you support gerrymandering (the manipulation of the boundaries of electoral constituencies to favor one election outcome over another)?*

Responses:

- ▶ Yes: 3
- ▶ No: 61

## Stage 2: Map Selection



# Politics and Gerrymandering

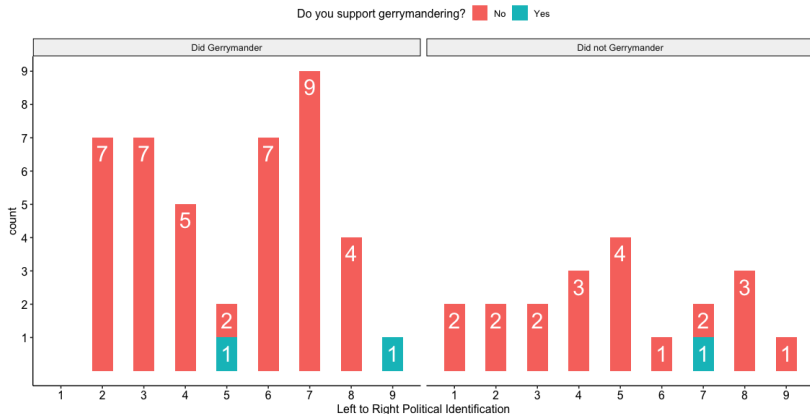
Subjects were also asked:

*On a scale of 1 to 9, how would you describe your political views with 1 being extremely liberal (i.e. to the left of the Democratic Party), 5 being centrist (i.e. falling between the Democratic Party and the Republican Party), and 9 being extremely conservative (i.e. to the right of the Republican party).*

Responses:

1	2	3	4	5	6	7	8	9
2	9	9	8	7	8	12	7	2

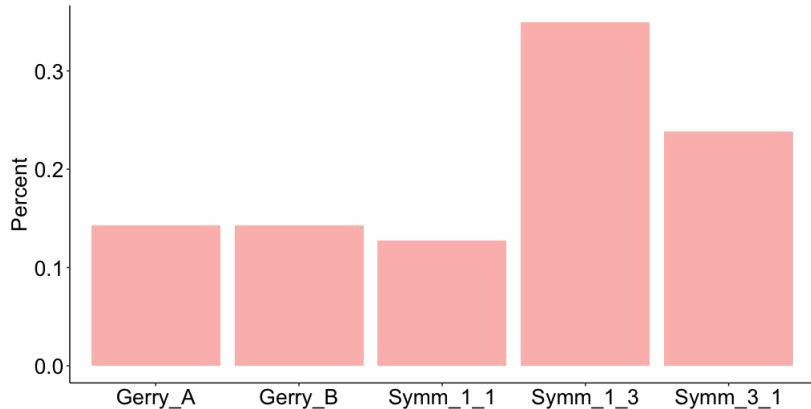
# Politics and Gerrymandering



$\chi^2$  test rejects gerrymandering depends on political views  
(p-value = 0.3106)

## Stage 3: Map Selection

People tend to pick symmetric maps when they do not know their role, **but not the socially optimal map.**



# Summary

- ▶ Subjects bid in an intuitive manner
  - ▶ (largely) ignore non-competitive districts
  - ▶ (over)bid on competitive districts on average
  - ▶ evidence in  $Symmetric_{3,1}$  of minimal winning coalitions
  - ▶ gerrymandering leads disadvantaged people to be discouraged on average
- ▶ View on gerrymandering
  - ▶ report not liking gerrymandering, regardless of political persuasion
  - ▶ prefer to compete on (inefficient) “fair” maps when they cannot be self-serving
  - ▶ overwhelmingly engage in gerrymandering when they can