

**Empirical Validation of Automated Redistricting Algorithms on the Virginia  
House of Delegates District Map**

Madeleine Goertz

International Community School

AP Research

Randall S. Huberman

May 20th, 2021

# Empirical Validation of Automated Redistricting Algorithms on the Virginia House of Delegates District Map

## Literature Review

Get writing!

## Method

Notes, this is still a rough draft.

### Choice of Research Method

For this study, I chose to use the experimental design method because it will allow me to isolate the hypothetical impact of the redistricting algorithm from other possible confounding variables. This method also includes the use of a control group, which allows the researcher to establish causation.

### *Experimental Units*

The experimental units for this study are the complete datasets for each election year in Virginia. I have one dataset for each of these years: 2015, 2017, 2019. Every row in each dataset corresponds to a precinct, the smallest geographical unit by which votes are tabulated in Virginia. For each precinct, I have the following attributes: total population, population by race, total voting-age population (VAP)(population over the age of 18), VAP by race, total votes for the democratic House of Delegates (HOD) candidate, total votes for the Republican HOD candidate, and the total votes for any other HOD candidate. Additionally, each precinct has a polygon associated with it that represents its geographical shape.

### *Treatments*

The treatments for this study are the three different redistricting algorithm that I'm comparing: Markov chain Monte Carlo (Fifield et al., 2020), Sequential Monte Carlo

(McCartan & Imai, 2020), and Random Seed Growth (Chen & Rodden, 2013).

## **Results**

## **Discussion**

## **Conclusion**

## References

- Chen, J., & Rodden, J. (2013). Unintentional gerrymandering: Political geography and electoral bias in legislatures. *Quarterly Journal of Political Science*, 8(3), 239–269. <https://doi.org/10.1561/100.00012033>
- Fifield, B., Higgins, M., Imai, K., & Tarr, A. (2020). Automated redistricting simulation using Markov chain Monte Carlo. *Journal of Computational and Graphical Statistics*, 0(0), 1–14. <https://doi.org/10.1080/10618600.2020.1739532>
- McCartan, C., & Imai, K. (2020). Sequential Monte Carlo for sampling balanced and compact redistricting plans. *arXiv:2008.06131 [cs, math, stat]*. Retrieved January 28, 2021, from <http://arxiv.org/abs/2008.06131>