Project Notes:

Project Title: TBD

Name: Ravena Arun

Note Well: There are NO SHORT-cuts to reading journal articles and taking notes from them. Comprehension is paramount. You will most likely need to read it several times, so set aside enough time in your schedule.

Contents:

Commented [CK1]: 10/8/2024 4 full entries

Make sure you check your APA citation format. Thanks for providing detailed captions for your pasted figures/graphs.

Commented [2]: remember to share with Dr. C.

Commented [3]: Table of contents will be generated if using a HEADER format for each sub-section.

KEEPING THIS UP-TO-DATE WILL HELP YOU when it comes time to write your thesis.

Knowledge Gaps:

This list provides a brief overview of the major knowledge gaps for this project, how they were resolved and where to find the information.

Knowledge Gap	Resolved By	Information is located	Date resolved
Can sensory recall (remembering specific music, taste, etc.) help patients with dementia or age-related memory loss?	Finding a journal article (Age and familiarity effects on music memory) that answered this question	In notes of Article #2	07/28/2024
What factors influence voter decisions (specifically voter abstention)?	Reading a journal article about factors that influenced voter abstention in the 2002 Brazil Presidential Election	In notes of Article #3	08/11/2024
How does climate change impact bird migration patterns?	Reading a journal article about the shifts in annual cycle stages caused by climate change.	In notes of Article #4	09/08/2024
Is there variation of climate change-induced migration pattern changes between bird species? Possibly genetic or ecological factors?			
What factors are considered when creating electoral districts?			

What are flaws or problems with current mathematical models to prevent gerrymandering?			
How are existing mathematical models to reduce gerrymandering created?			

Literature Search Parameters:

These searches were performed between (Start Date of reading) and XX/XX/2025.

List of keywords and databases used during this project.

Database/search engine	Keywords	Summary of search
Google	Gerrymandering	Definition: To manipulate boundaries of an electoral constituency to favor one party or class (Oxford Languages)
Google Scholar	Bird migration patterns	Found a research article on tracking in ornithology and the effect of climate change on the annual life stages of birds
Google		

Google		
Google		
Google		
Google		
Google		

Tags:

Tag Name	
#biochem	#politics
#migration	#physcology
#chem	#neurology
#gerrymandering	#mathmodeling

Article # Notes: Title

Article notes should be on separate sheets

KEEP THIS BLANK AND USE AS A TEMPLATE

Source Title	
Source citation (APA Format)	
Original URL	
Source type	
Keywords	
#Tags	
Summary of key points + notes (include methodology)	
Research Question/Problem/Need	
Important Figures	
VOCAB: (w/definition)	
Cited references to follow up on	
Follow up Questions	

Article #1 Notes: Reversible multielectron transfer I−/IO3− cathode enabled by a hetero-halogen electrolyte for high-energy-density aqueous batteries

Source Title	Reversible multielectron transfer I$^-$/IO$_3^-$ cathode enabled by a hetero-halogen electrolyte for high-energy-density aqueous batteries
Source citation (APA Format)	Xie, C., Wang, C., Xu, Y., Li, T., Fu, Q., Li, X. (2024). Reversible multielectron transfer I$^-$/IO$_3^-$ cathode enabled by a hetero-halogen electrolyte for high-energy-density aqueous batteries. *Nature Energy, 9*, 714–724. https://doi.org/10.1038/s41560-024-01515-9
Original URL	https://www.nature.com/articles/s41560-024-01515-9
Source type	Journal Article
Keywords	Aqueous battery, energy density, electron transfer
#Tags	#chem #energy #battery
Summary of key points + notes (include methodology)	The article describes a new aqueous battery design developed by researchers in China that is more energy-efficient and safer than a typical lithium battery. Lithium-ion batteries have a high energy density, but the organic chemicals found in its electrolyte, the liquid part, of the battery can cause it to combust if the system overheats. Water-based batteries are much safer, but have a lower energy density because they have a narrower electrochemical stability window. Most water-based batteries use iodine as its mediator, additives that help move electrons through redox reactions. Unfortunately, iodine has slow reaction rates and creates unwanted byproducts leading to a low-energy-density battery. However, Xiafeng Li, from the Chinese Academy of Sciences, and his colleagues were able to use chemistry to develop a mixed halogen electrolyte that could create a battery with a lifetime of more than 1,000 charge-discharge cycles. This improvement in energy density was achieved by combining bromide and iodide ions into an electrolyte to increase the reaction rate and suppress the creation of unnecessary byproducts. The bromide ions served as a crucial additive that immensely improved the speed and efficiency of electron transfer. In a series of consequent studies, the researchers found that the bromide-iodide electrolyte

	significantly improved the energy density across various common battery types. Li and his team hope that their research will promote water-based batteries as a cheaper, safer, and high-energy-density alternative to current technologies.
Research Question/Problem/ Need	How can current knowledge of chemistry and electrodes be applied to engineering cheaper, safer, and more effective batteries?
Important Figures	Figure 1 Figure 1 is showing the electron transfer of I- with and without the addition of Br-. This shows that the voltage of the combined electrons (I- with Br-) is significantly higher than I- alone.
VOCAB: (w/definition)	Electrolyte – a substance that breaks into ions when dissolved in water Mediator – an electron transfer agent that permits efficient oxidation of Li_2O_2 Electrochemical stability window – the electrode and electric potential range

	between which the substance is neither oxidized nor reduced
Cited references to follow up on	Huskinson, B. et al. A metal-free organic-inorganic aqueous flow battery. *Nature* **505**, 195–198 (2014). Weng, G.-M., Li, Z., Cong, G., Zhou, Y. & Lu, Y.-C. Unlocking the capacity of iodide for high-energy-density zinc/polyiodide and lithium/polyiodide redox flow batteries. *Energy Environ. Sci.* **10**, 735–741 (2017). Raspi, G., Pergola, F. & Guidelli, R. Electrooxidation of iodine on smooth platinum in aqueous media. *Anal. Chem.* **44**, 472–479 (2002). Lee, Y. et al. An organic imidazolium derivative additive inducing fast and highly reversible redox reactions in zinc-bromine flow batteries. *J. Power Sources* **547**, 232007 (2022).
Follow up Questions	Are there other halides that will yield similar or better results as combining I- and Br-? Could this energy creation be applied to other technologies other than batteries?

Article #2 Notes: Age and familiarity effects on musical memory

Source Title	Age and familiarity effects on musical memory
Source citation (APA Format)	Sauvé, S. A., Satkunarajah, P., Cooke, S., Demirkaplan, Ö., Follett, A., Zendel, B. R. (2024). Age and Familiarity Effects on Musical Memory. *PLOS ONE*, *19*(7), e0305969–e0305969. https://doi.org/10.1371/journal.pone.0305969
Original URL	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0305969
Source type	Research Article
Keywords	Age, tonal patterns, music, recognition
#Tags	#neurology #physcology #music #dementia
Summary of key points + notes (include methodology)	One of my prospective ideas is researching if and why creative memories are more likely to be preserved compared to semantic memory in dementia patients. An article from Nature relates to this topic by explaining research that suggests "memory for music doesn't diminish with age". Sarah Sauvé, a feminist music scientist in the UK, sought to study the effect of music recall, but in a real-world setting, a concert. Sauvé's participants consisted of 90 healthy adults ranging in ages of 18 to 86. They listened to three pieces of music either live at the Newfoundland Symphony Orchestra in St John's, Canada or via recording in a laboratory. Three different pieces were played: one which most participants were familiar with, one tonal and easy to listen to, and one more atonal and unique. The researchers found that there was no correlation between age and the ability of participants to recognize the themes of the pieces. Steffen Herff, a cognitive neuroscientist, hypothesized that musical memory may be unaffected by age because of the emotions that music evokes which serves as an 'importance stamp' in the brain. Music also follows certain patterns, which can make it easier for people to predict themes. Ultimately, this research could provide more insight on "cognitive scaffolding," or using music as a memory aid for other information. This could significantly improve the lives of people with dementia or other

	neurodegenerative conditions.
Research Question/Problem/Need	Does age affect ability to recognize music?
Important Figures	Figure 1

Age Range	Questionnaire							Cognitive Tests			
	# of participants	Years of education	Hours of activity	Hours of socializing	Hours listening to music	Years of formal musical training	Hearing Abilities self-assessment	# of participants	Letter-numbers sequencing	Trail Making A	Trail Making B
<20	5	15.0	4.0	5.0	7.0	7.7	22.8	1	12.0	16.6	30.1
21–30	19	17.8	7.3	6.6	5.3	7.4	21.2	6	9.3	18.9	40.1
31–40	14	18.9	6.0	5.1	7.4	9.4	21.8	7	12.0	17.1	33.7
41–50	13	17.4	5.0	4.7	4.5	7.9	22.4	4	13.0	19.3	37.0
51–60	20	18.3	6.3	6.6	7.9	6.6	24.3	10	10.1	25.7	49.6
61–70	12	18.2	6.3	5.0	4.7	4.6	25.6	5	10.4	27.6	46.5
71–80	9	18.4	7.0	6.0	5.3	6.0	22.0	0	-	-	-
80+	0	-	-	-	-	-	-	-	-	-	-

https://doi.org/10.1371/journal.pone.0305969.t001

This is a table that contains the results of the initial questionnaire of the participants. It demonstrates that despite changes in age, the results, even for the "Hearing Abilities self-assessment" column are consistent.

VOCAB: (w/definition)	Semantic – relating to meaning in language or logic Cognitive scaffolding – a teaching and tutoring method in which the tutor controls elements of a task that are beyond the student's initial abilities. It allows the students to focus on completing the parts of the task they do know.
Cited references to follow up on	Hedden T, Gabrieli JDE. Insights into the ageing mind: a view from cognitive neuroscience. Nat Rev Neurosci. 2004;5: 87–96. pmid:14735112 Andrews MW, Dowling WJ, Bartlett JC, Halpern AR. Identification of speeded and slowed familiar melodies by younger, middle-aged, and older musicians and nonmusicians. Psychol Aging. 1998;13: 462. pmid:9793121 Román-Caballero R, Arnedo M, Triviño M, Lupiáñez J. Musical practice as an enhancer of cognitive function in healthy aging—A systematic review and meta-analysis. PLOS ONE. 2018;13: e0207957. pmid:30481227 Haaland KY, Price L, Larue A. What does the WMS–III tell us about memory

	changes with normal aging? 2001. Krumhansl CL. Cognitive foundations of musical pitch. Oxford University Press; 1990.
Follow up Questions	How could this be applied to use cognitive scaffolding as a method to slow the onset of dementia?

Commented [13]: Questions are crucial in leading you towards the next paper. This is a MANDATORY section and should include AT LEAST 3 Questions that stem from reading the paper.

Article #3 Notes: Relevant Factors for the Voting Decision in the 2002 Presidential Election: An Analysis of the ESEB (Brazilian Electoral Study) Data

Source Title	Relevant Factors for the Voting Decision in the 2002 Presidential Election: An Analysis of the ESEB (Brazilian Electoral Study) Data
Source citation (APA Format)	de Souza Carreirão, Y. (2007). Relevant Factors for the Voting Decision in the 2002 Presidential Election: An Analysis of the ESEB (Brazilian Electoral Study) Data. *Brazilian Political Science Review*, *1*(1), 70–101. https://doi.org/10.1590/1981-3824200700010004
Original URL	https://www.scielo.br/j/bpsr/a/vrN9GPDmFMfjnfxp6BxGrSc/?lang=en#
Source type	Journal Article
Keywords	Brazilian politics; presidential elections; electoral behavior
#Tags	#politics #phsycology #voteranalysis
Summary of key points + notes (include methodology)	One of my potential project ideas was a statistical analysis of the factors of voter abstention. The scientific publication I chose discusses the factors that affected voters' decisions in the 2002 Brazil presidential election. Yan de Souza Carreirão from the Federal University of Santa Catarina, Brazil researched the most relevant factors that affected voters by making hypotheses and testing them using logistic regression analyses. The data came from the Brazilian Electoral Study, ESEB, which provides access to a national sample of voters. However, the ESEB models demonstrated that political opinions did not strongly affect voters' decisions. The study also found that the factors that influenced individual Brazilian voters varied greatly. The most frequent variables observed were the voters' religion, "party sentiments", positioning on a left-right scale, evaluations of the existing

	government, and candidates' characteristics. This research can be very useful to presidential candidates' marketing teams and in generally understanding voters' process in determining which candidate to vote for.
Research Question/Problem/ Need	What factors influenced voter decisions in the 2002 Brazil Presidential Election?
Important Figures	Table 5 (table below) This table shows the voting intention of interviewees and their religion. It demonstrates that several of the voters made decisions based on their religion, or at least, people from the same religious group tend to make similar voting choices.
VOCAB: (w/definition)	Logistic regression analysis – an analysis used to examine the association of categorical or continuous independent variable(s) with one dichotomous dependent variable
Cited references to follow up on	Converse, Phillip. 1964. "The nature of belief systems in mass publics". In *Ideology and discontent*, ed. D. Apter. New York: Free Press. Popkin, Samuel L. 1994. *The reasoning voter – comunication and persuasion in presidential campaigns* 2nd ed. Chicago: The University of Chicago Press. Weisberg, Herbert, and Steven Greene. 2003. "The political psychology of party identification". In *Electoral democracy*, ed. Michael MacKuen and George Rabinowitz. Ann Arbor: The University of Michigan Press.

Table 5

Candidate	Religion			Total
	Catholic church	Evangelical churches	Others; no religion	
Lula	47	22	42	43
Serra	21	12	16	19
Garotinho	5	39	8	11
Ciro	9	3,5	7	8
Other responses [*]	18	23	26	19
Total (N)	(1753)	(375)	(385)	(2513)

	Lewis-Beck, Michael. 1988. *Economics & elections: The major western democracies* Ann Arbor: The University of Michigan Press.
Follow up Questions	Do these factors change across countries/cultures? Maybe religion is a greater factor in one country than in another.

Article #4 Notes: Climate change leads to differential shifts in the timing of annual cycle stages in a migratory bird

Source Title	Climate change leads to differential shifts in the timing of annual cycle stages in a migratory bird
Source citation (APA Format)	Tomotani, B. M., Jeugd, H., Gienapp, P., Hera, I., Pilzecker, J., Teichmann, C., & Visser, M. E. (2017). Climate change leads to differential shifts in the timing of annual cycle stages in a migratory bird. *Global Change Biology*, *24*(2), 823–835. https://doi.org/10.1111/gcb.14006
Original URL	https://onlinelibrary.wiley.com/doi/10.1111/gcb.14006
Source type	Primary research article
Keywords	Cycle stages, fitness, breeding, moult, migration
#Tags	#ornithology #climatechange #migration
Summary of key points + notes (include methodology)	The researchers used data of a population of European pied flycatchers to investigate the varying advancements of three main cycle stages: spring migration, breeding, and the start of post-breeding moult. The researchers found that moult advanced faster, but spring migration was unaffected by advancements in the breeding time; this trend continued as the temperature increased. The shortened intervals between cycle stages did not affect clutch size nor adult survival, but earlier breeding gave chicks a higher probability of surviving into adulthood.
Research Question/Problem/ Need	How does climate change affect other annual cycle stages in relation to the timing of breeding and consequently the fitness of birds?
Important Figures	Figure 2

This figure shows the general trend of clutch size has steeply decreased recently and the annual life stages of birds has shifted back to be later in the season because of climate change.

VOCAB: (w/definition)	Phenology - the study of cyclic and seasonal natural phenomena
	Moult – shedding old feathers
	Clutch size - the number of eggs laid in a single brood by a nesting pair of birds
Cited references to follow up on	Both, C., Bijlsma, R. G., & Ouwehand, J. (2016). Repeatability in spring arrival dates in pied flycatchers varies among years and sexes. *Ardea*, **104**, 3–21. **https://doi.org/10.5253/arde.v104i1.a1**
	Eikenaar, C., & Schmaljohann, H. (2014). Wind conditions experienced during the day predict nocturnal restlessness in a migratory songbird. *Ibis*, **157**, 125–132.
	Jenni, L., & Kery, M. (2003). Timing of autumn bird migration under climate change: Advances in long-distance migrants, delays in short-distance migrants. *Proceedings of the Royal Society B-Biological Sciences*, **270**, 1467–1471. **https://doi.org/10.1098/rspb.2003.2394**
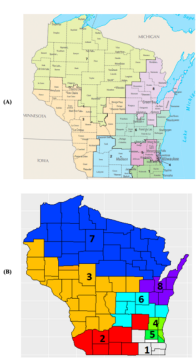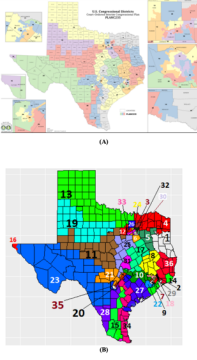
Follow up Questions	Why was adult survival unaffected by the shortened intervals? Could the advancements of migration and moult in relation to breeding be different if other species of birds, other than European pied flycatchers, were studied? Why does moult advance faster, but spring migration remains unaffected by shifts in breeding time?

Article #5 Notes: Alleviating partisan gerrymandering: can math and computers help to eliminate wasted votes?

Source Title	Alleviating partisan gerrymandering: can math and computers help to eliminate wasted votes?
Source citation (APA Format)	Chatterjee, T., DasGupta, B., Palmieri, L., Al-Qurashi, Z., Sidiropoulos, A. (2018). Alleviating Partisan Gerrymandering: Can Math and Computers Help to Eliminate Wasted Votes? *ArXiv (Cornell University)*. https://doi.org/10.48550/arxiv.1804.10577
Original URL	https://arxiv.org/pdf/1804.10577
Source type	Journal Article
Keywords	gerrymandering
#Tags	#gerrymandering #politics #mathmodeling
Summary of key points + notes (include methodology)	- The US Supreme court ruled in 1986 that gerrymandering is justiciable, but they stated that a measure of partisan symmetry could be helpful in eliminating gerrymandering - Two frequent indicators cited for lack of partisan symmetry are *cracking*, namely dividing supporters of a specific party between two or more districts when they could be a majority in a single district, and *packing*, namely filling a district with more and more supporters of a specific party if this does not make this specific party the winner in that district. - Chatterjee, et. al, was originally introduced to a new measure of gerrymandering called the "efficiency gap" from two papers published by McGhee and Stephanopoulos in 2014 and 2015 respectively - The efficiency gap is deemed mathematically precise measure of gerrymandering and was considered sufficient legal evidence to claim that Wisconsin is gerrymandered (a case then-pending in the Wisconsin supreme court) - The researchers began by formalizing the method and then studying its mathematical properties

	- This demonstrated that the efficiency gap measure attains only a *finite discrete set* of *rational* values; these properties are of considerable importance in understanding the sensitivity of the measure and in designing efficient algorithms for computing this measure - For their solution, Chatterjee, et. al designed a rapid randomized algorithm - The results showed that the model was able to effectively reduce the efficiency gap using the suggested district borders in the four tested swing states (Wisconsin, Texas, Pennsylvania, and Virginia) - The new number of seats was (relatively) the same for Wisconsin, Texas, and Pennsylvania, but in Virginia the new democrats almost reached the new republicans
Research Question/Problem/ Need	Central question: How can a mathematical algorithm be created to "quantify" gerrymandering and a lack of partisan symmetry by minimizing the efficiency gap?
Important Figures	Figures 5 and Figure 6 show the current (above) electoral district borders and the non-gerrymandered optimized ones (below) for Wisconsin and Texas respectively. Figure 5: The district maps of Wisconsin: (A) original [36] and (B) after applying our local search algorithm in Fig. 4. Figure 6: The district maps of Texas: (A) original [38] and (B) after applying our local search algorithm in Fig. 4. Figures 7 and 8 show the current (above) electoral district borders and the non-gerrymandered, optimized one (below) for Virginia and Pennsylvania respectively.
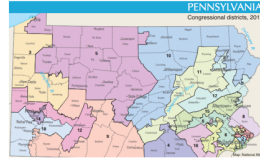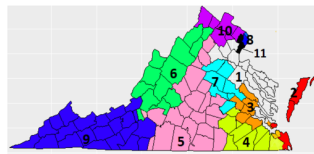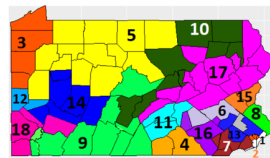
Figure 7: The district maps of Virginia: (A) original [34] and (B) after applying our local search algorithm in Fig. 4.

Figure 8: The district maps of Pennsylvania: (A) original [32] and (B) after applying our local search algorithm in Fig. 4.

Table 2 shows the efficiency gaps of the current electoral districts and the efficiency gap of the math model's optimized map. This data represents that gerrymandering can impact the number of democratic and republican (GOP) seats, especially in Virginia.

| | Number of Seats | | | | Normalized efficiency gap | |
| | Original | | New | | $\text{Effgap}_K(\mathcal{P},\ldots)/\text{Pop}(\mathcal{P})$ | |
	Democrats	GOP	Democrats	GOP	Original	New
Wisconsin	3	5	3	5	14.76%	3.80%
Texas	12	24	12	24	4.09%	3.33%
Virginia	3	8	5	6	22.25%	3.61%
Pennsylvania	5	13	6	12	23.80%	8.64%

Table 2: Redistricting results obtained by running the algorithm in Fig. 4 for the states of Texas, Wisconsin, Virginia and Pennsylvania in comparison to the 2012 district plans.

VOCAB: (w/definition)	Combinatorial optimization problem – There is one optimal solution from a finite set of options, where each feasible solution is discrete
	GOP – Republican party
	Discrete – Unique
	Efficiency gap – The absolute difference of total wasted votes between the parties in a two-party electoral system
	Formalize a problem – Enter it into a computer proof assistant
	Partisan symmetry – A standard for defining partisan gerrymandering that involves the computation of counterfactuals typically under the assumption of uniform
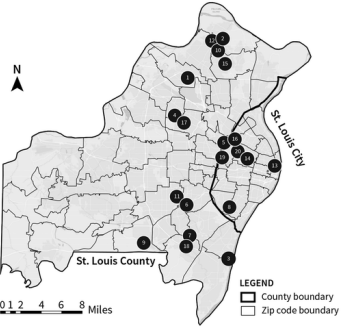
	swings
	Justiciable – Subject to trial in a court of law
Cited references to follow up on	E. McGhee, Measuring partisan bias in single-member district electoral systems. *Legislative Studies Quarterly* 39(1), 55-85 (2014).
	J. E. Ryan, The limited influence of social science evidence in modern desegregation cases. *North Carolina Law Review* 81(4), 1659-1702 (2003).
	M.R.Garey,D.S.Johnson,*ComputersandIntractability-AGuidetotheTheoryofNP-Completeness* (W. H. Freeman & Co., San Francisco, CA, 1979).
	M. Altman, A Bayesian approach to detecting electoral manipulation. *Political Geography* 21, 39-48 (2002).
	E. Aarts, J. K. Lenstra (Editors), *Local Search in Combinatorial Optimization* (Princeton University Press 2003).
Follow up Questions	What are the shortcomings of this model?/What factors were not accounted for?
	Why did the number of seats for democrats and republicans not change even when the efficiency gap percent decreased significantly?
	Are gerrymandering prevention math models, like this one, applicable in any other situations or problems?

Article #6 Notes: Voting Infrastructure and Process: Another Form of Voter Suppression?

Source Title	Voting Infrastructure and Process: Another Form of Voter Suppression?
Source citation (APA Format)	Pitzer, K., Mcclendon, G. G., Sherraden, M. (2021). Voting Infrastructure and Process: Another Form of Voter Suppression? *Social Service Review*, *95*(2), 175–209. https://doi.org/10.1086/714491
Original URL	https://www.journals.uchicago.edu/doi/10.1086/714491
Source type	Journal Article
Keywords	Voting infrastructure, voter turnout, racial composition, income level, social work, voter suppression
#Tags	#politics
Summary of key points + notes (include methodology)	- Researchers found that voting infrastructure and process were affect by the district's race and average income - Also hypothesized that a higher percentage of African American and Latinx American voters lowers incomes in a concentrated district would have voting barriers in infrastructure and process resulting in a lower voter turnout - The study supported all the above hypotheses - Sample size of 20 (small) - The researcher's methodology involved observing voting condition outside of polling sites - They did not collect data on the accessibility of polling sites - The researchers found that 3 of 35 constructs reached significance at probability of 0.5 or below - The study concluded that electoral bias still exists and unfairly sways elections by supporting wealthy White voters - Also states that social workers have the power to strengthen democracy through access to voting - The limitations of this study were its small sample size and lack of data on how physical design choices of buildings may affect polling-site accessibility and voter turnout - Future research could be completed to minimize these limitations stated above and test different methods to actually improve on this problem

Research Question/Problem/ Need	How does the race and income of neighborhoods affect voting infrastructure and process, and thus voter turnout?
Important Figures	Figure 1 displays a map with all the polling locations selected for this study. This demonstrates that this study was relatively limited because it only conducted research across one state and the cities may have similar racial and income-based demographics. Table 3 shows the variables collected at each polling site. This demonstrates how the researchers quantified or "defined" voter accessibility (by wait times, physical accessibility, police pressure, pressure by electioneers, and more).

TABLE 3. Percentage of Black Residents and Voting Infrastructure and Process Variables, Correlation Analyses (*N* = 20)

Variable	τ_b	*p*
Address visibility	−.04	.404
Building name visibility	.04	.584
Difficulty to find	.13	.223
Street signs directing voters to polling location	.24	.902
Road blockages	.20	.149
Parking space availability	−.08	.311
Quality of walkway	−.29	.043
Disability accessibility	−.28	.047
Path obstruction	.18	.166
Signage to entrance	−.01	.469
Entrance clearly marked	.09	.681
Visibility of disability-access sign	−.36	.024
Polling location preparation	−.12	.258
Number of electronic machines	−.11	.271
Number of paper ballot stations	−.16	.171
Number of poll pads	−.06	.356
Number of election judges	−.49	.002
Number of poll workers	.17	.854
Line count at 6:00 a.m.	−.23	.076
Line count at 7:00 a.m.	−.16	.163
Line count at 8:00 a.m.	.09	.711
Line count at 5:00 p.m.	.17	.154
Line count at 6:00 p.m.	.35	.022
Line count at 7:00 p.m.	.51	.008
Line wait at 6:00 a.m.	.10	.721
Line wait at 7:00 a.m.	−.04	.410
Line wait at 8:00 a.m.	.02	.539
Line wait at 5:00 p.m.	−.23	.909
Line wait at 6:00 p.m.	.10	.282
Line wait at 7:00 p.m.	.30	.102
Interference with free passage of voters	.37	.021
Police presence	.16	.183
Pressure by electioneers	.06	.353
All voters in line voted after close	.05	.414
Discussions of difficulty voting	−.05	.609

Note.—Kendall's tau-b correlations used for all tests.

VOCAB: (w/definition)	Kendall's tau-b correlations – A nonparametric measure of the strength and direction of association that exists between two variables measured on at least an ordinal scale Tract type – A type of housing development in which multiple similar houses are built on a tract (area) of land that is subdivided into smaller lots
Cited references to follow up on	Edelstein, William A., and Arthur D. Edelstein. 2010. "Queuing and Elections: Long Lines, DREs and Paper Ballots." In Proceedings of the 2010 Electronic Voting Technology Work- shop/Workshop on Trustworthy Elections (EVT/WOTE '10). Washington, DC, August 9– 10. http://www.usenix.org/events/evtwote10/tech/full_papers/Edelstein.pdf. Glaser, Barney G., and Anselm L. Strauss. 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine. McEldowney, Renee, and Pamela B. Teaster. 2009. "Land of the Free, Home of the Brave: Voting Accommodations for Older Adults." Journal of Aging and Social Policy 21 (2): 159–71. US Government Accountability Office. 2017. "Voters with Disabilities: Observations on Poll- ing Place Accessibility and Related Federal Guidance."

	Report to Congressional Request- ers, GAO-18-4, December 4 revision. US Government Accountability Office, Washington, DC. Wilcox, R. R. 2009. Basic Statistics: Understanding Conventional Methods and Modern In- sights. Oxford: Oxford University Press.
Follow up Questions	What other factors might affect voter turnout or may be unknowingly causing voter suppression? Would the results of this study be the same with a greater sample size spanning across the nation?

Article #7 Notes: Information gerrymandering and undemocratic decisions

Source Title	Information gerrymandering and undemocratic decisions
Source citation (APA Format)	Stewart, A. J., Mosleh, M., Diakonova, M., Arechar, A. A., Rand, D. G., Plotkin, J. B. (2019). Information gerrymandering and undemocratic decisions. *Nature*, *573*(7772), 117–121. https://doi.org/10.1038/s41586-019-1507-6
Original URL	https://www.nature.com/articles/s41586-019-1507-6
Source type	Research Letter
Keywords	Informational gerrymandering, democracy, voter game
#Tags	#background #politics
Summary of key points + notes (include methodology)	- The researchers developed a "voter game" model to study how voting decisions can be affected by social networks - This game involved players on an "influence network" where they had to make voting intensions based on their observations of the group network - The researchers were able to show that it led to biases, undemocratic outcomes even when there were equal party sizes - They found asymmetric "influence assortment" can lead to information gerrymandering and unfairly advantage the more diverse party - They observed this in their model and in real-life political networks (in online discussions and debates) - This study demonstrated the dangers and immense impact of collective decision-making - It distorts facts and can lead to informational gerrymandering
Research Question/Problem/ Need	How can social networks and the flow of information affect voter decisions?
Important Figures	Figure 3 demonstrates the outcomes of the model voter game. This shows the undemocratic nature and polarization that occurred as a result of social networks being formed. It provides an effective visual representation of the results discussed in the study.

a $\mathcal{A}_I = 0.0, \mathcal{G}_I = 0.0$ — Vote share (yellow team), Frequency. Experiment, Model.

b $\mathcal{A}_I = 0.42, \mathcal{G}_I = 0.5$ — Vote share (favoured team), Frequency.

c $\mathcal{A}_I = 0.5, \mathcal{G}_I = 0.52$ — Vote share (favoured team), Frequency.

d $\mathcal{A}_I = 0.39, \mathcal{G}_I = 0.0$ — Vote share (yellow team), Frequency.

e $\mathcal{A}_I = 0.76, \mathcal{G}_I = 0.0$ — Vote share (yellow team), Frequency.

VOCAB: (w/definition)	- Asymmetric "influence assortment" – when one party's members are more exposed to their own party's views - Deadlock – a situation involving two opposing parties where no further progress can be made
Cited references to follow up on	Matz, S. C., Kosinski, M., Nave, G. & Stillwell, D. J. Psychological targeting as an effective approach to digital mass persuasion. *Proc. Natl Acad. Sci. USA* 114, 12714–12719 (2017). Newport, F. Americans favor compromise to get things done in Washington. *Gallup*https://news.gallup.com/poll/220265/americans-favor-compromise-things-done-washington.aspx(2017). Bail, C. A. et al. Exposure to opposing views on social media can increase political polarization. *Proc. Natl Acad. Sci. USA* 115, 9216–9221 (2018). Briatte, F. Network patterns of legislative collaboration in twenty parliaments. *Netw. Sci*. 4, 266–271 (2016). Conover, M. et al. Political polarization on Twitter. In *ICWSM* 89–96 (2011).
Follow up Questions	What solutions are there to informational gerrymandering? Does the effect of informational gerrymandering on people vary based on other factors (geographical location, age, party, etc.)?

Commented [20]: Questions are crucial in leading you towards the next paper. This is a MANDATORY section and should include AT LEAST 3 Questions that stem from reading the paper.

Article #8 Notes: Mathematical models of political districting for more representative governments

Source Title	Mathematical models of political districting for more representative governments
Source citation (APA Format)	Liu, H., Erdogan, A., Lin, R., & Tsao, H.-S. . J. (2020). Mathematical models of political districting for more representative governments. *Computers & Industrial Engineering*, *140*, 106265. https://doi.org/10.1016/j.cie.2019.106265
Original URL	https://www.sciencedirect.com/science/article/pii/S036083521930734X?via%3Dihub
Source type	Journal Article
Keywords	Political districting, math modeling, optimization, fairness, competitiveness
#Tags	#mathmodeling #politics
Summary of key points + notes (include methodology)	- Several challenges to drawing up the district borders - The Constitution requires compactness, geographical contiguity, and population balance across every district - The majority of existing literature and software tools on political districting focus on achieving the non-political constitutional requirements - However, elections and redistricting are political processes and should be treated like so - The researchers formulated two mathematical optimization models to implement two new criteria: fairness and competitiveness - Fairness – ensures seats are fairly allocated to political parties using voter decisions - Competitiveness – aims to maximize the number of competitive districts to prevent districting solutions that clearly favor one political party over another - The two optimization models were implemented with a South Carolina case study - The model underwent six scenarios to demonstrate their effectiveness and efficiency - The model is easily modifiable and can be manipulated to account for three or more political parties
Research Question/Problem/	How can electoral districts be altered to reduce gerrymandering and account for

Need	political factors and fairness and competitiveness?
Important Figures	Figure 1 shows the current electoral borders. It provides a baseline of the regular distance values before using the optimization values to add in fairness and competitiveness.
VOCAB: (w/definition)	NP-complete – Shortened form of "nondeterministic polynomial-time complete" that means the problem is only solvable in polynomial time. NP-complete problems are considered very difficult, if not impossible, to truly solve. NP-hard – Shortened form of "non-deterministic polynomial-time hardness" and represents a defining property of a class of problems. NP-hard problems are very difficult NP problems
Cited references to follow up on	A districting experiment with a clustering algorithm; Annals of the New York Academy of Sciences, 219 (1) (1973), pp. 209-214 Optimal political districting by implicit enumeration techniques; Management Science, 16 (8) (1970), p. 508 Computers and intractability: A guide to the theory of NP-completeness; W.H Freeman and Company, San Francisco (1979) An optimization-based heuristic for political districting; Management
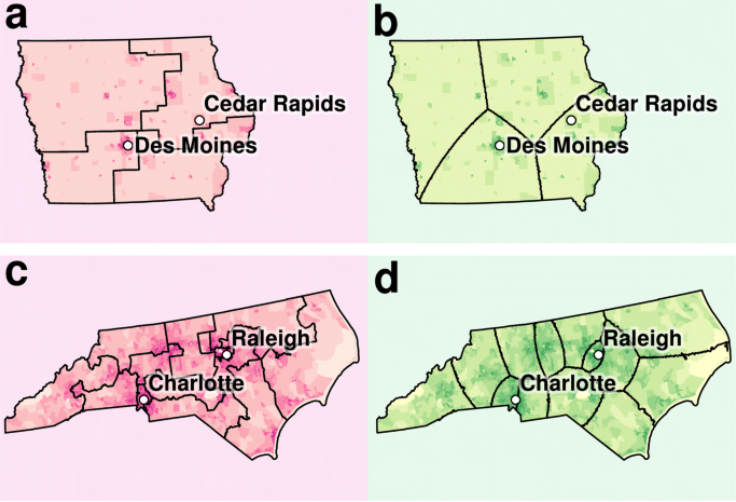
	Science, 44 (8) (1998), pp. 1100-1114
	Political districting: From classical models to recent approaches; Annals of Operations Research, 204 (1) (2013), pp. 271-299
Follow up Questions	Are there other effective mathematical optimization models that also consider political factors? If so, how do they compare to this model?
	Is there a way to use this model to analyze current districts and provide a score or quantifiable description of the gerrymandering present?

Article #9 Notes: Gerrymandering and computational redistricting

Source Title	Gerrymandering and computational redistricting
Source citation (APA Format)	Guest, O., Kanayet, F.J. & Love, B.C. Gerrymandering and computational redistricting. *Journal of Computational Social Science, 2*, 119–131 (2019). https://doi.org/10.1007/s42001-019-00053-9
Original URL	https://link.springer.com/article/10.1007/s42001-019-00053-9#citeas
Source type	Research Article
Keywords	Partisan gerrymandering, computational models, redistricting
#Tags	#politics #mathmodeling
Summary of key points + notes (include methodology)	- Partisan gerrymandering is a threat to democracy - However, redistricting fairly is a task that may exceed human capacities - One possible solution is to use computational models to automate redistricting by optimizing criteria - Researchers developed a model that minimizes pairwise distance between voters in a district - The model was further tested using US Census Bureau data - The researchers' prediction was confirmed that the difference in compactness between the actual and optimized districts would be greater for larger states - A greater difference in compactness correlates to difficulty in properly redistricting - So, larger states are more difficult to redistrict - The computer model was able to fully optimize the properties and criteria to draw the district boundaries more accurately than humanly possible - An ideal model should also consider municipal boundaries, historic communities, and relevant legislation in addition to compactness
Research Question/Problem/ Need	How can computer models be used to optimize criteria and develop district maps with reduced gerrymandering – a feat unachievable using solely current human capabilities?
Important Figures	Figure 3 shows the actual (a,c) and computed (b,d) district maps for Iowa (a,b) and

North Carolina (c,d). Darker areas represented a densely populated location. This provides a visual representation of the changes the computer model made. Even with a general visual figure, the viewer is able to immediately recognize that the optimized maps appear cleaner and of more even distribution.

VOCAB: (w/definition)	Potts model – A mathematical tool that studies the interaction of internal elements to determine a complex's overall behavior
	Homogeneous – Containing terms all of the same degree

Cited references to follow up on	Altman, M., Magar, E., McDonald, M. P., & Trelles, A. (2014). The effects of automated redistricting and partisan strategic interaction on representation: The case of Mexico. SSRN. https://doi.org/10.2139/ssrn.2486885
	Gutiérrez-Ándrade, M. A., García, E. A. R., de-los-Cobos-Silva, S. G., Ponsich, A., Gutiérrez, R. A. M., & Velázquez, P. L. (2016). Redistricting in Mexico. In A. Fink, A. Fügenschuh, M. J. Geiger (Ed.), *Operations Research Proceedings 2016, Selected Papers of the Annual International Conference of the German Operations Research Society (GOR), Helmut Schmidt University Hamburg, Germany, August 30–September 2, 2016. Operations Research Proceedings* pp. 301–306. Springer
	Mahajan, M., Nimbhorkar, P., & Varadarajan, K. (2012). The planar k-means problem is NP-hard. *Theoretical Computer Science*, *442*, 13–21. (Special Issue on the Workshop on Algorithms and Computation (WALCOM 2009)).
	Ponsich, A., García, E. A. R., Gutiérrez, R. A. M., Silva, S. G. d.-l.-C., Andrade, M. A. G., & Velázquez, P. L. (2017). Solving electoral zone design problems with NSGA-II:

	Application to redistricting in Mexico. In *Proceedings of the Genetic and Evolutionary Computation Conference Companion*, GECCO '17, pp. 159–160. ACM, New York, NY, USA.
Follow up Questions	How could this model be refined to account for other factors? Why did the researchers focus on compactness? Was it their perceived most important factor?

Article #10 Notes: Measuring Political Gerrymandering

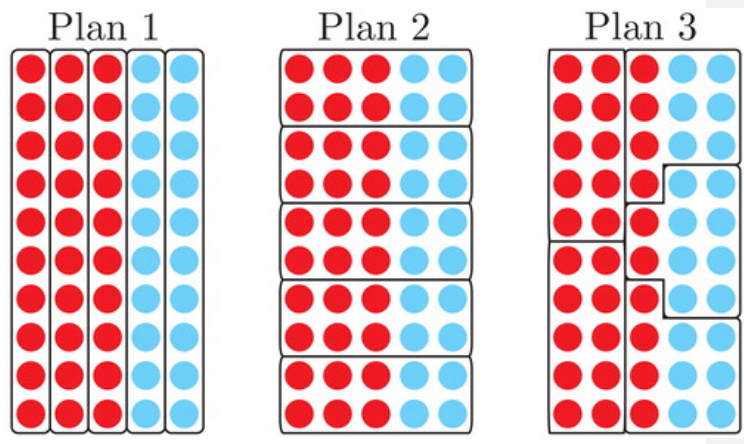| Source Title	Measuring Political Gerrymandering
Source citation (APA Format)	Tapp, K. (2019). Measuring Political Gerrymandering. *The American Mathematical Monthly*, *126*(7), 593–609. https://doi.org/10.1080/00029890.2019.1609324
Original URL	https://www.tandfonline.com/doi/full/10.1080/00029890.2019.1609324?scroll=top&needAccess=true#abstract
Source type	Journal Article
Keywords	Gerrymandering, math modeling, the efficiency gap, competitiveness
#Tags	#politics #mathmodeling
Summary of key points + notes (include methodology)	- The efficiency gap made headlines after being considered a valid means of quantifying gerrymandering by Wisconsin's Supreme Court - Since then several equations have surfaced that take inspiration from, build on, or replace Stephanopoulos and McGhee's *efficiency gap* formula - Three gerrymander detection measurements were compared: EG (efficiency gap), REG1, and REG2 (relative efficiency gap). - EG was doubled to have the same range as REG1 and REG2 - The researchers found that EG was not effective in lopsided elections - REG2 and REG1 were more effective in providing meaningful answers in extreme cases - REG2 is not affected by proportionality - McGhee expressed less enthusiasm for REG2 because it failed his efficiency principle that "a gerrymander detection measurement must increase when party A increases its seat share without any corresponding increase in its vote share".
Research Question/Problem/ Need	Which of the several efficiency gap-inspired models is the most effective measure in quantifying gerrymandering?
Important Figures	Figure 1 is displaying three different ways to divide 50 voters into five districts. This is a helpful depiction that aids the readers in better understanding gerrymandering.

Figure 5 demonstrates the efficiency gap of the three plans from Figure 1. This demonstrates the connection between gerrymandering plans and efficiency gaps.
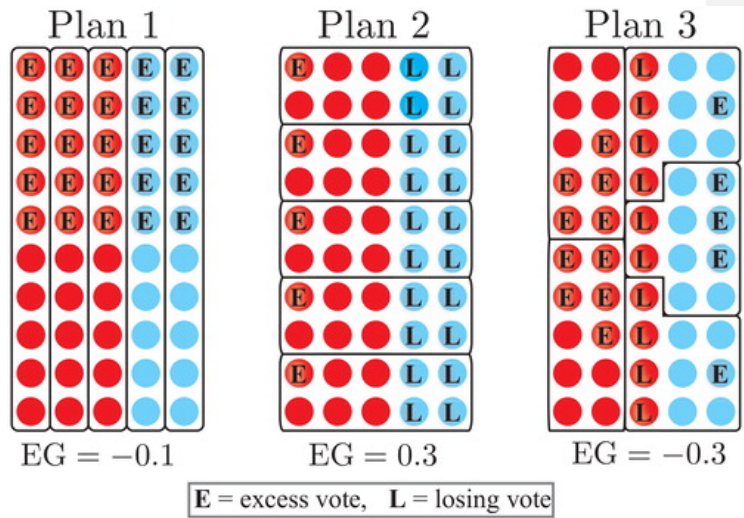
VOCAB: (w/definition)	Efficiency gap – The difference between two major US. political parties' wasted votes divided by the total number of votes
	Interpolate – Insert something of a different nature into something else

	Canonical - Relating to a general rule or standard formula.
Cited references to follow up on	Bernstein, M., Duchin, M. (2017). A formula goes to court: Partisan gerrymandering and the efficiency gap. Notices Amer. Math. Soc. 64(9): 1020-1024 Herschlag, G., Ravier, R., Mattingly, J. (2018). Evaluating partisan gerrymandering in Wisconsin. arxiv.org/abs/1709.01596 Nagle, J. (2017). How competitive should a fair single member districting plan be? Elect. Law J. 16(1): 196–209 Veomett, E. (2018). The efficiency gap, voter turnout, and the efficiency principle. Elect. Law J. 17(4): 249–263.
Follow up Questions	Is there another measure that can quantify gerrymandering more accurately than the efficiency gap? How is the efficiency gap affected by the inclusion of other factors like compactness?

Commented [26]: Questions are crucial in leading you towards the next paper. This is a MANDATORY section and should include AT LEAST 3 Questions that stem from reading the paper.

Patent #1 Notes: Neutral redistricting using a multi-level weighted graph partitioning algorithm

|	
Source Title	Neutral redistricting using a multi-level weighted graph partitioning algorithm
Source citation (APA Format)	Magleby, D. B. & Mosesson, D. B. (2018). *Neutral redistricting using a multi-level weighted graph partitioning algorithm* (U.S. Patent No. US20180342030A1). U.S. Patent and Trademark Office. https://patentimages.storage.googleapis.com/c9/21/ca/29c446a86602ff/US20180342030A1.pdf
Original URL	https://patents.google.com/patent/US20180342030A1/en?q=(gerrymandering)&oq=gerrymandering
Source type	Patent
Keywords	Gerrymandering, redistricting, partition algorithm
#Tags	#politics #mathmodeling
Summary of key points + notes (include methodology)	- The patent is for a system and method that evenly partitions a map into multiple disjoint regions - Each region represents a respective continuous bounded geographical area - The data is partitioned so that the partitioning objectives and distinct conditions are followed - The model operates by creating a plurality of maps that are based on several initial conditions and distinctness criteria - The plurality of maps is then compared by fitness criterion and the optimal solution is chosen
Research Question/Problem/ Need	How can a map be partitioned to adhere to a plurality of criteria?
Important Figures	The following parts of Figure 1 demonstrate visualizations of stages of the methodology. Figure 1a shows the initial map with current gerrymandering.
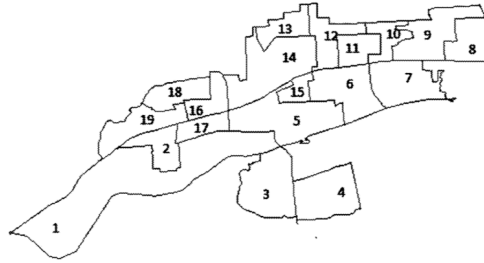
Fig. 1A
Initial Map

Figure 1B shows the same current map, but post-simplification. Only the district borders are emphasized and it is ready for further manipulation of the model.
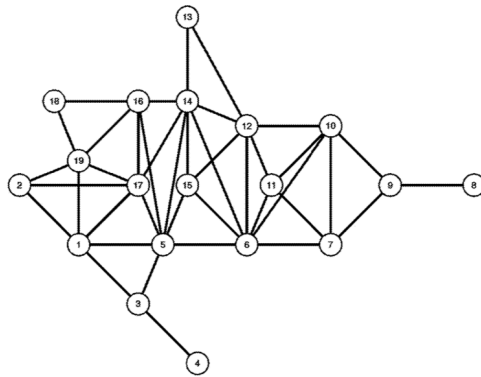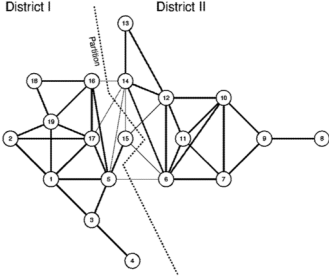

Fig. 1B
Simplified Graph

Figure 1F shows the final optimized partition of the graph. This version best met the criteria of the several maps the model produced.

District I   District II

Fig. 1F
Optimal Partition of the Graph

VOCAB: (w/definition)	Idiosyncrasies – A distinctive or peculiar feature or characteristic of a place or thing Planar graph – A graph that can be embedded in the plane Laplacian matrix – A matrix that represents the correlation of clumn vectors in a graph matrix
Cited references to follow up on	Altman, Micah, Brian Amos, Michael P. McDonald and Daniel A. Smith. 2015. "Revealing Preferences: Why Gerrymanders are Hard to Prove, and What to Do about It."Available at SSRN 2583528. Dube, Matthew P., and Jese T. Clark."Beyond the Circle: Measuring District Compactness Using Graph Theory." InAnnual Meeting of the Northeastern Political Science Asociation. 2016. Karypis, G.; Kumar, V. (19). "Afastandhigh quality multilevel scheme for partitioning iregular graphs". SIAM Journal on Scientific Computing. 20(1): 359-392. doi:10.1137/S1064827595287997.
Follow up Questions	What is especially unique about this model compared to the others? How did Magleby and Mosesson draw inspiratiom from the efficiency gap? Which specific parts of their model use Stephanopoulos and McGhee's earlier research?

Patent #2 Notes: Electoral integrity assessment method, and system

Source Title	Electoral integrity assessment method, and system
Source citation (APA Format)	Vickery, C., Shein, E., Darnolf, S. (2014). *Electoral integrity assessment method, and system* (U.S. Patent No. US20140207694A1). U.S. Patent and Trademark Office. https://patentimages.storage.googleapis.com/19/8c/b3/cc2712bb557935/US20140207694A1.pdf
Original URL	https://patents.google.com/patent/US20140207694A1/en
Source type	Patent
Keywords	Electoral districts, intensity of impact, elections, politics
#Tags	#politics
Summary of key points + notes (include methodology)	- The inventors compiled a list of all guidelines and ranked them from Low to High for levels of fraud, malpractice, and systemic manipulation - The researchers were aiming to create a method of evaluating electoral integrity - The patent is for a method and system that includes a qualitative and quantitative assessment.
Research Question/Problem/ Need	How can electoral integrity fairly be evaluated?
Important Figures	This figure was not assigned a label, but it was included on the front page of the patent document. This was the final solution that the inventors develop: a chart that can be used to effectively evaluate electoral integrity.

			Vulnerability	Intensity of Impact
---	---	---
0	No vulnerability (0% vulnerable)	No impact (will have no effect on election results or impact credibility of election process)
3	Somewhat vulnerable	Limited impact
5	Moderately vulnerable	Moderate impact
7	Highly vulnerable	High impact
10	Extremely high vulnerability (>95% vulnerable)	Extremely high impact (will change election results, render the elections unacceptable to key electoral stakeholders and trigger instability)	
VOCAB: (w/definition)	Ad hoc ballot – an unofficial ballot Expedite – Make an action or process happen sooner or be accomplished more quickly Arbiter –A person who has ultimate authority in a matter and settles a dispute
Cited references to follow up on	N/A
Follow up Questions	What factors does this model not consider? What are the shortcomings of the table? Are the considered factors specific to the US or do they apply to all government systems (not just bipartisan)?

Commented [28]: Questions are crucial in leading you towards the next paper. This is a MANDATORY section and should include AT LEAST 3 Questions that stem from reading the paper.