

US Presidential Electoral System: An Agent Based Approach of the US Presidential Election Process

Daniel Sharfarz^{a,b,c,@}

^a Cornell University

^b Jeb E. Brooks School of Public Policy

^c Cornell Institute for Public Affairs

@ email: ds879@cornell.edu

ABSTRACT: This paper will be utilizing a Systems Thinking Agent Based Approach (ABA) to model and understand the US presidential electoral system. Through this process, an understanding of the influential actors, their relationships with each other, and the end results of these interactions can be achieved. The goal of this analysis is to discover various recommendations for the current model that can alter the end behavior of it to more closely match its original desired function from the perspective of the US general public.

Keywords: election | politics | systems thinking | DSRP | Agent Based Approach | CAS | POSIWID

Cite this paper: Daniel Sharfarz (2022) US Presidential Electoral System: An Agent Based Approach of the US Presidential Election Process *Journal of Systems Thinking*. (22) 5.

Introduction

AS ONE OF THE most powerful individuals in the world, the president of the United States has a significant impact on nearly every aspect of government here in the US as well as significant influence with the country's foreign relations. With this individual wielding so much influence, an electoral system was designed and has been continually modified over the years in the hopes of ensuring the candidate selected to be president was competent and well qualified.

However, there has been significant criticism regarding this process that has called into question whether the electoral system is indeed generating the best results in terms of our nation's leader. These criticisms have been exacerbated in recent times by the controversiality and margins of victory of several candidates that have been elected in the last few decades.

Using an Agent Based Approach (ABA), I look at the electoral process in order to determine its true function (as opposed to the ideal function of successfully electing the most qualified candidate from the perspective of the US general public) as well as determining several recommendations that would help to change the system's current purpose to better match the ideal one.

Methods

THE US ELECTORAL SYSTEM, along with many other systems/processes, including Systems Thinking itself, can be considered what is known



as a Complex Adaptive System (CAS). A CAS can be defined as a system made up of agents each following their own set of simple rules that results in collective behavior that leads to an emergent property or behavior of that system as a whole¹. Because a CAS is made up of agents, understanding these agents and the rules they follow is essential to understanding the behavior of the system.

Why an Agent Based Approach (ABA)?

A CAS CAN TYPICALLY be modeled using two different approaches. The first method is Agent Based Modeling (ABM), which was the first and originally only method in order to model a CAS when the concept was first developed. ABM essentially simulates agents following their simple rules interacting with each other, resulting in those interactions creating the emergent behavior of the system as a whole. While, in theory, ABM is an excellent method for modeling a CAS, in reality there are significant limitations to ABM that preclude its usefulness for the purpose of modeling our system and many others².

ABM requires, firstly, that the simple rules the agents in a CAS are following are perfectly understood and accurately portrayed in the model. Given the complexity of the various agents involved in the US electoral system, this alone prevents the use of ABM, as our current understanding of psychology and neuroscience is not sufficient to perfectly understand and model all of the simple rules human and human-related agents would follow.

Secondly, the more detailed a CAS is, the more processing power is needed in order for ABM to work. Modeling done via ABM typically requires a computer and computer expertise for all but the most basic systems. For something involving as many agents and as much detail as an electoral system, the technical requirements to simulate such a model would be far beyond the resources and expertise readily available to all but the most affluent of groups, and even then may not be feasible due to current technological limitations.

Due to the above mentioned limitations of ABM, the ABA method was developed as a practical alternative that could be used without the strict requirements needed in order to effectively utilize ABM. For this reason, ABA was chosen to model the electoral system rather than ABM.

¹ Mulyono, Y.O., Sukhbaatar, U., and Cabrera, D., "Hard" and "Soft" Methods in Complex Adaptive Systems (CAS): Agent Based Modeling (ABM) and the Agent Based Approach (ABA), in *Routledge Handbook of Systems Thinking*, edited by Laura Cabrera Midgley, Derek Cabrera, Routledge, vol. 20, 2021

² 1

Steps to an Agent Based Approach (ABA)

ABA IS CONSIDERED the “softer” method of modeling a CAS, and is broken down into several steps, as can be seen in the illustration below.

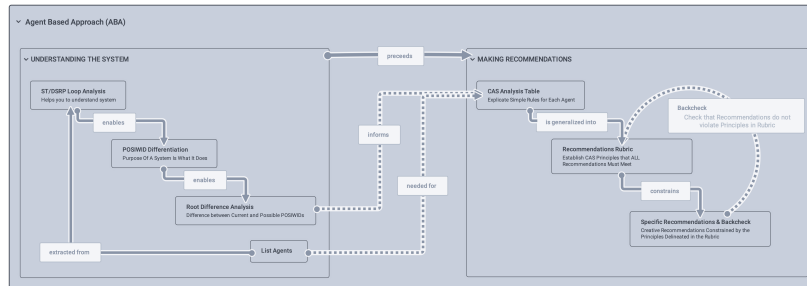


Figure 1: ABA Model

Step 1: DSRP Analysis of the System

THE FIRST STEP of the ABA is to model the system through the use of the Systems Thinking (ST) Distinctions, Systems, Relationships and Perspectives (DSRP) loop in order to better understand it. DSRP theory states that all cognition can be broken down into four functions that operate in tandem and simultaneously³.

³ 2; 3; and 4

1. Distinctions, Identity-Other: The process of distinguishing ideas and concepts from others in order to identify and differentiate them.
2. Systems, Part-Whole: Every system functions because it is made up of parts, each distinct from each other, but interacting in order to create the system. In turn, each system is itself a part of a greater system, and each part can be considered a system in itself, made up of smaller parts.
3. Relationships, Action-Reaction: All systems and their parts are related to each other in some form. While the relevancy of these relationships can vary based on the system and what aspects are trying to be understood, a relationship between each component exists and can yield actions and reactions from them as a result.
4. Perspectives, Point-View: When relationships and boundaries are distinguished through modeling, these actions are done through a certain perspective. Each component of a system (and each

system) can have its own perspective, which can affect how these relationships and boundaries are drawn.

As Systems Thinking itself can be considered a CAS, DSRP can be considered the simple rules the system follows in order to yield a product. For the purposes of this project, the DSRP loop was utilized in order to map out the electoral model on computer software called Plectica. This map can be considered the “emergent behavior” of systems thinking via the use of the DSRP loop, facilitating a better understanding of the electoral system we are studying through its use.

Step 2: POSIWID and CAS Analysis

THE SECOND STEP of the ABA process is to determine the current purpose of the system and identify the agents in a system and the simple rules those agents follow through the use of CAS analysis.

The true Purpose of a System is What it Does (POSIWID). For human created systems such as the electoral system, there is typically an announced intended purpose (why the system was created) and the actual purpose that can be discovered by looking at the difference between the intended purpose and the emergent behavior that the system yields. Understanding the actual POSIWID, the ideal intended POSIWID, and what aspects of this system result in the discrepancy between the two is essential in order to utilize ABA⁴.

⁴ 1

In addition to understanding a system’s purpose, one must also understand what components of a system can be considered agents and the simple rules that they follow. Through the use of CAS analysis, one determines the agents and rules in a system, which are the key components of effecting change in purpose⁵.

⁵ 2

Step 3: Rubric and Recommendations

LASTLY, a rubric is created, serving as a guideline to create recommendations that could change the system to more closely follow the desired POSIWID. In theory, there are near infinite recommendations that could be made to a system to change the POSIWID. However, in reality, most of the options are typically impractical from an execution standpoint. Creating a rubric before actually coming up with recommendations allows for one to set guidelines that recommendations must follow in order to increase the likelihood that they would be feasible in practice.

Results

DSRP Analysis of the System

THE USE OF THE DSRP LOOP resulted in a Plectica map that was used as a guideline to determine the POSIWID, agents, rules, and recommendations. Since there are relationships between every entity, and each system is itself a part of a greater system, a map model could, in theory, expand out infinitely to include every aspect of the known universe. However, since the purpose of this map is not to model the universe, but to better understand the US electoral system, framing and stopping rules (i.e. “fropping”) were established in order to limit the map size and keep the content relevant to the topic. For this map, dropping rules were set to include only actual participants in elections and campaign aspects related to just the presidential election. As a result of these rules, some aspects such as voter turnout and down ballot voting options were not included.

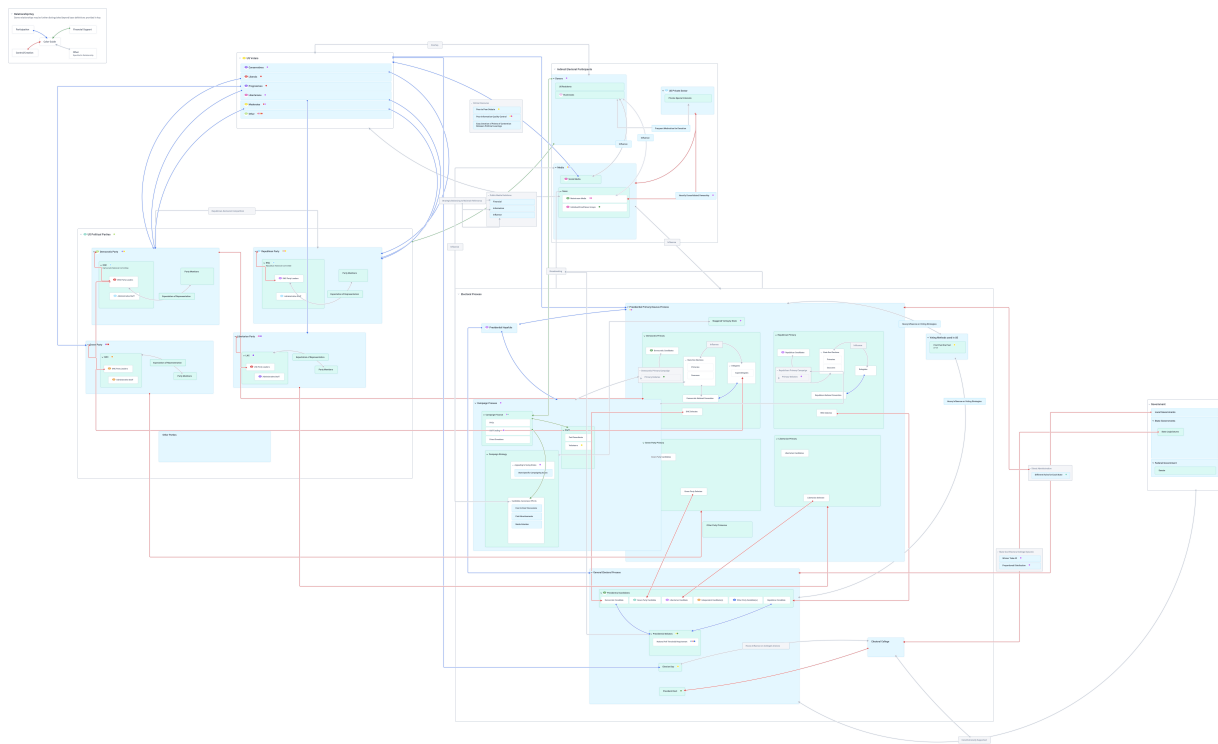
While, in reality, the four rules of DSRP are happening simultaneously, when it comes to physical modeling, such an approach is not possible. Each rule is worked on separately in order to complete the map. While there is no required order in which this must be done, I have found it easier to start mapping using the order of the DSRP acronym, distinctions first, then systems, then relationships, then perspectives, repeat. First, various subsystems of the over electoral system were distinguished and listed on the map, an image showing some of these distinct components of the electoral system are listed below.

As each system is itself made of parts, the subsystems shown above were further broken down into their specific parts. In addition, relationships between various parts and subsystems that were deemed relevant to the model were illustrated and defined, as well as perspectives that each part may have regarding other components of the system. To illustrate this, a breakdown of the subsystem listed as “Indirect Electoral Participants” is shown below. This image displays the various parts of this system, their relationships with each other, and their perspectives.

While not necessarily shown in the above images, relationships and perspectives between these subsystems and between different parts of different systems were also illustrated on the map. Many of these relationships are themselves systems that must be further defined.

In addition to each aspect of DSRP being detailed on the map, the use of Structural Predictions were essential in order to achieve the

Figure 2: Plectica Map



level of detail shown and the level of understanding of the system. Structural Predictions are used to predict the structure of a system in the absence of information. Structural Predictions can be used to determine where a distinction, system, relationship, or perspective might take place in order to provide a guideline of what future information might be needed in order to understand that system. The empty structures can later be filled in as additional information on the system is acquired. An example shown in the image above is the relationship between mainstream media and private special interests. DSRP logic states that there is a relationship between mainstream media and private special interests, so the relationship was created as a template for future analysis. Later, information was acquired regarding the state of the mainstream media in the US to define that relationship as US media companies possessing heavily consolidated ownership of mainstream media outlets.

The use of the Systems Thinking Feedback loop (ST Loop) was also essential for the creation of the map. The ST Loop requires the finding of real world sources in order to confirm that the modeled system matches reality as closely as possible. The ST loop was necessary both to determine the accuracy of the DSRP loop when

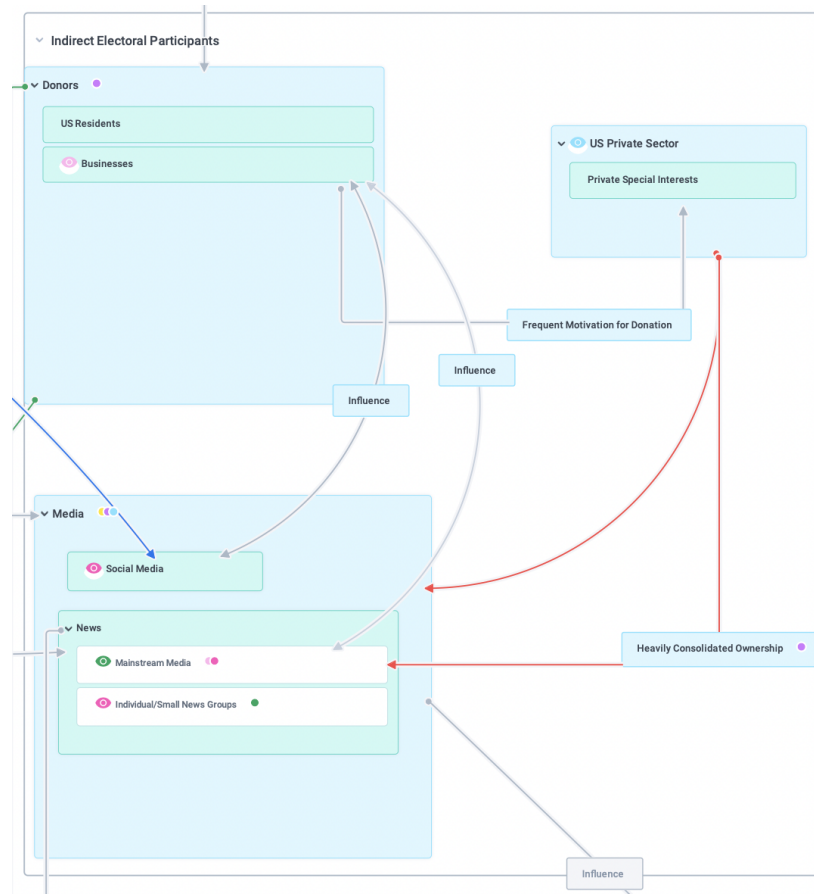


Figure 3: Examples of Plectica Map Perspectives

creating the map, as well as to fill in informational gaps created by the use of Structural Predictions. It was utilized several times for this map, referencing educational materials and academic papers to confirm that the structure of the map was accurate along with the information listed.

POSIWID Analysis

ONCE THE DSRP MAP was created, the POSIWID(s) of the system needed to be determined. By looking at some of the issues the US presidential electoral system is criticized for and comparing that to the desired results allowed for the creation of both the current POSIWIDs as well as the future ones. Analysis of the DSRP map and the system as a whole could then be used to determine the root differences between these POSIWIDs. Through this process, the three current POSIWIDs, their ideal POSIWID counterpart, and the perceived differences between the two were created and shown in

the below table.

Problem Statement	Current POSIWID	Future POSIWID	Root Difference
Votes for a candidate in a state that is won by another candidate are essentially discounted.	The current system is effective at discounting the votes of a significant portion of Americans.	The ideal system should count the vote of every individual.	“Winner Take All” electoral college delegate allocation for the majority of states vs. proportional allocation/no electoral college.
Campaigning is expensive and requires significant funding that most candidates do not have readily available.	The current system is effective at giving disproportionate political influence to those best able to fund a candidate’s campaign.	The ideal system should not give disproportionate influence to the wealthiest individuals.	Private campaign financing vs. public funding being available for candidates.
Candidates must be either a Democrat or Republican (and win the associated primary for that party) in order to have a realistic chance in the general election.	The current system is effective at greatly limiting the range of candidates (and therefore, issues) that voters can base their decision on.	The ideal system should allow for a greater variety of issues in which voters can decide on.	Two Party System vs. Multiparty System/No Political Parties.

Table 1: POSIWID Analysis

CAS Analysis

IN ADDITION TO THE POSIWIDS, the DSRP map is also important in the CAS analysis to determine the agents and their rules. In order to be considered an agent in the system, there must be multiple copies of that “component” in the system, they must follow simple rules, and these rules must result in a significant impact on the system as a whole⁶. Simple rules in this context are very similar to the idea of POSIWID, i.e. these are rules that the agents actually follow rather than what they should “ideally” be doing. These criteria were used to determine the below agents in the US electoral system, their rules, and the resulting system behavior.

⁶ 2

It should be noted that since these agents are all humans or composed of humans, the behavior even among individual agents can vary greatly (a major reason why ABM would be impractical for this). As a result, some of the simple rules can be viewed as generalizations. With regards to modeling human based systems, however, this is a necessary compromise. No model is going to be completely accurate, but as long as the generalizations are sound and as closely based on real world information obtained through the ST Loop as possible, then the model can remain useful.

Rubric and Recommendations

List of Salient Agents	Current Simple Rules	Current System Level Behavior
Voters	1. Vote in the primary for the candidate seen as most likely to defeat voter's political opposition in the general. 2. Obtain information to make an informed decision. 3. Convince others to vote as they do.	Candidates are selected for their perceived ability to defeat the political opposition rather than their actual platform or capabilities.
Political Parties	Maintain long term viability of the party itself.	Parties may place their own financial well being above the preferences of their members and party leadership will favor candidates that are the least likely to threaten their financial infrastructure.
States	1. (for most states) Administer elections utilizing First Past the Post voting. 2. (for most states) Assign all electoral college delegates to the candidate with the most votes in that state.	The candidate with the most votes receives all of the state's electoral delegates. Votes for other candidates in that state are essentially discounted.
Media Outlets	1. Ensure financial viability by maintaining viewership rates. 2. Interpret news through a lens that is more favorable towards the political leanings of the media outlet's ownership.	Media is sensationalized to keep viewers engaged rather than informed and typically has a bias to influence viewers to support a belief held by the ownership of that outlet.
Presidential Candidates	1. Acquire resources needed to run campaign from those that can provide it. 2. Be elected president.	Candidates often shift their platform from what is originally stated to one that is more palatable for those funding the campaign in order to secure resources for victory.

Table 2: CAS Analysis

ONCE THE SYSTEM WAS MODELED, the purpose determined, and the agents and their rules identified, my understanding of the system was sufficient to form a rubric listing the requirements recommendations would need to meet, as well as the recommendations themselves. The below table shows the recommendation rules and the proposed recommendations formed as a result of this analysis.

Recommendation Rubric

No specific recommendation should violate these rules:

1. Recommendations cannot be unconstitutional.
2. Recommendations should not require an active change in more than one set of agents.
3. Recommendations must be able to be realistically executed in modern US society.

Specific Recommendations

1. Intervention/Recommendation 1: Implement Ranked Choice voting in state administered elections for both party primaries and the general election.
2. Intervention/Recommendation 2: Create more public campaign finance opportunities for candidates to reduce or even eliminate candidates' dependency on private funding in elections.
3. Intervention/Recommendation 3: Implement proportional allocation for electoral college delegates in all states currently using a "winner take all" system.
4. Intervention/Recommendation 4: Amend the 1996 Telecommunications Act to once again limit the number of media outlets an individual corporation can own and control.
5. Intervention/Recommendation 5: Reduce the polling threshold requirements in order to participate in the general election debates.

Discussion

DSRP Analysis of the System

THE PRIMARY PURPOSE of the creation of a map using the DSRP loop is to better understand the system being studied. For me, this map achieved that goal through two primary means. The first way

was the map itself providing an overall scaffolding in which to organize thoughts around, and the second was utilizing Structural Predictions to determine areas of key importance that might need more research or serve as an important target for a recommendation. The key areas of focus that were determined through this process were highly influential on the recommendations that were later formed. For example, the relationship between the president elect and election day greatly helped to show the influence the Electoral College has on the process, as shown in the below screenshot of my map.

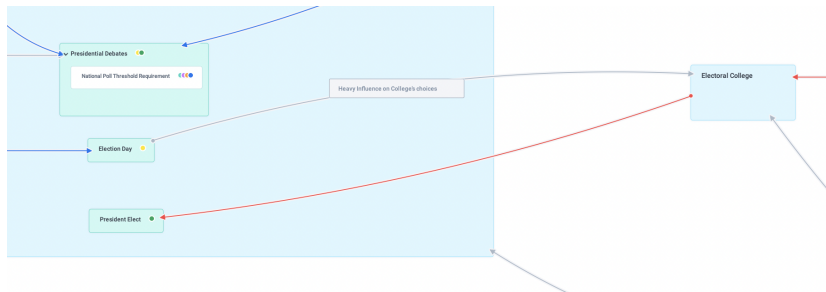


Figure 4: Electoral College Influence

As they say, a picture is worth a thousand words. While there is a direct relationship of control (defined by the red arrow) between the college and the president elect, the election results merely influence the electoral college. College delegates are not outright required to vote based on the actual results of their state. This indirect control along with the “winner take all” delegate system used in most states helps the map to illustrate the criticism many individuals have regarding this aspect of our electoral system, as well as why it is a focus area for one of the recommendations. Another example of how the structure of the map provided insight into potential recommendations was the map illustration of the general election debates, shown below.

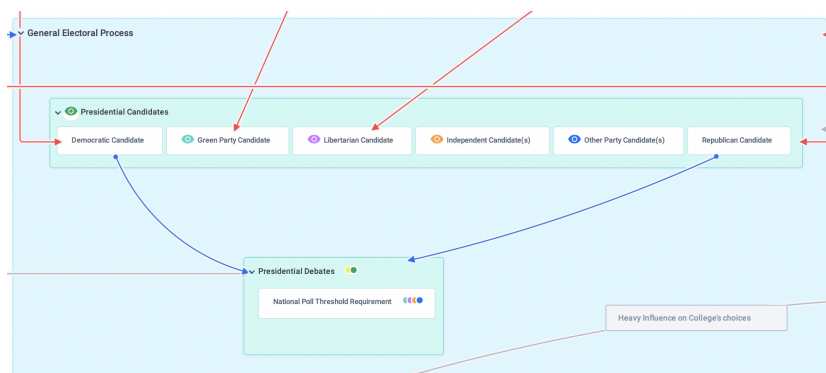


Figure 5: General Electoral Process

Here, the map shows that despite the large number of candidates

from various parties (or with no party affiliation), only the Democratic and Republican candidates typically participate in the presidential debates due to other candidates being unable to meet the poll threshold requirements of 15% in at least 5 nationally held polls. With other campaigning opportunities being much less likely to be viewed by voters or covered by the media, this threshold requirement effectively limits both the discourse in debates, and the number of options that the average voter is even aware of when entering the voting booth.

POSIWID Analysis

THE CURRENT POSIWIDS of the system were determined by looking at the emergent behaviors of said system and how they differed from the desired results. These differences were determined both through the analysis of the DSRP map as well as through the use of the ST Loop for confirmation. For example, the first POSIWID listed stating the system discounts a significant amount of votes for a candidate can be confirmed in the real world through several means, perhaps one of the most noticeable of these being the recent history of the US electing several presidents that actually lost the popular vote. The fact that a candidate can win an election with fewer votes confirms that the system counts some votes as worth more than others. Regardless of whether this behavior was intentionally implemented or not doesn't matter, the system's purpose is to discount certain votes because that is what happens in practice. The use of the map and the ST Loop are also quite important in determining the root differences between the actual POSIWID and the proposed. Understanding the nature of the "winner take all" system most states use explains why many votes are discounted, and simultaneously suggests the mechanism in which this shift in purpose can be achieved.

The same approach was used for the remaining two current POSIWIDS of the system. A lack of availability of public campaign funding, the existence of which is confirmed through the ST Loop, in addition to the large amount of money needed to fund a campaign clearly illustrates a potential conflict of interest for a candidate that must weigh their or their voters' belief in a policy with the ability to get funding from those wealthy enough to provide it. Similarly, the fact that presidential victors are always either Republicans or Democrats (confirmed both by the ST Loop of election results as well as through the analysis of the psychological "spoiler effect") shows a clear lack of variety in the choices a voter can realistically make in the general election.

CAS Analysis

UNDERSTANDING AGENTS and their rules is essential to understanding the system since the system is a result of their emergent behavior. Through the logic of ABA, it is determined that the best way to affect a system is to change one or more of the simple rules an agent is following. The five agents selected all have a significant impact on the electoral system. For some agents, how this influence works is quite obvious. For example, voters determine a candidate through their vote, so changing their behavior would clearly change the election results. However, the influence an agents' actions have is not always as obvious, states being a prime example of this. Changing the states' simple rule of using a "winner take all" system would not only give equal weight to votes, but also change the psychology of the voters, as knowing their vote will count more makes them more likely to become invested in participating and spending more time on their decision⁷. Through the active changing of a single rule for States, one can indirectly change simple rules others are following (in this case, voters) and yield a bigger impact on the system as a result.

⁷ 5

Rubric and Recommendations

THE UTILIZATION OF ABA for the US presidential electoral system yielded 5 single action recommendations that would change one or more simple rules an agent would follow while keeping with the listed requirements in the rubric. Here I will discuss the reasoning and logic behind these recommendations and how they should work to alter the current POSIWID to be closer to the desired one.

The first recommendation of implementing ranked choice voting would change a single simple rule that the states follow, the "First Past the Post" system mentioned previously. Of all the recommendations listed, I believe this one would be the most impactful on changing the current system. Currently, presidential election results always yield a Democrat or a Republican, a large part of this can be attributed to the spoiler effect associated with first past the post voting⁸. Ranked choice voting would allow for voters to rank their preferences for a candidate, meaning that should their preferred candidate have insufficient votes, their vote would instead go to their next most preferred candidate. Such a rule change would, in theory, change the simple rules that voters follow as well, as now they would vote based on their own preferences rather than voting on the single candidate that they feel would be best qualified at preventing their opposition's

⁸ 6

candidate from taking power. This change would also give increased viability to third parties, as individuals would be able to vote for them without risking the chances of their preferred primary party. With voters being the largest and most directly influential group of agents that are part of this system, a recommendation that would fundamentally change the rules they follow would logically have the largest impact.

The second recommendation of creating more public funding opportunities would be a change done through the states or the federal government, but would change the rules that presidential candidates follow. By creating a source of campaign funding outside the influence of the wealthiest individuals in the country, candidates would have less incentive to not be transparent and less likely to compromise their platform in order to gain conditional financial support.

The third recommendation of removing the “winner take all” system for delegate allocation in states would be yet another change that would be done through the states and would alter a rule the states follow. Ideally, the electoral college would be abolished entirely in order to make election results based purely off the popular vote. However, the electoral college is included in the constitution, and abolishing it would require a constitutional amendment, something that can be considered a near impossible task in today’s political climate (and so violates rules 1 and 3 listed on the recommendation rubric). The more realistic alternative is to make states assign delegates in proportion to their election results. This issue by itself would largely eliminate the current system POSIWID of votes being discounted. Additionally, studies have shown that in higher stakes, decision makers are more likely to spend more time making an informed decision. Voters in states that normally always went either blue or red, would suddenly realize that their vote would have more meaning, and would be more likely to invest time into making an informed decision as a result⁹.

⁹ 5

The fourth recommendation to amend the 1996 Telecommunications Act would be implemented through the federal government, and would affect the rules followed by Media outlets. This recommendation would not necessarily outright change the rules that media outlets follow, instead, it would serve to dilute the impact one of the rules has on the system. Media outlets have been shown to interpret news through a lens that more closely aligns with the views of that outlet’s owners¹⁰. The 1996 Telecommunications act allowed for the significant consolidation of US media. Since the act was passed, media ownership has been consolidated to the point where 6 corporations control 90% of all news outlets. Given media’s propensity

¹⁰ 7

to interpret news to coincide with the views of their owners, a consolidation of ownership entails fewer interpretations of the news available to the public, and each of those interpretations having more influence on and exposure to the public. Ideally, the media should just report the news as objectively as possible, but such a behavior could likely only be achieved through regulation. With government regulation of the media being a touchy and often unpopular subject in US politics, the more feasible recommendation was to simply undo the change made by the Telecommunications Act to encourage a greater diversity of opinion and interpretation in the news.

The last recommendation of lowering or perhaps even removing the national poll threshold requirement would be implemented through the non-profit Commission of Presidential Debates (CPD) and would influence the simple rules followed by the voter. Voters are typically interested in making an informed decision, but real world responsibilities can severely limit the time available to gather this information¹¹. These time limitations often mean that voters must rely on information about candidates that is more readily available, one of the most prominent sources of these being the presidential debates recorded and broadcasted by the media. Reducing the poll threshold would allow for more diversity of opinions in the debates, and as a result, voters would readily have information about all of the candidates running, and not just the primary two.

¹¹ 5

References

- [1] Mulyono, Y.O., Sukhbaatar, U., and Cabrera, D., ““Hard” and “Soft” Methods in Complex Adaptive Systems (CAS): Agent Based Modeling (ABM) and the Agent Based Approach (ABA)”, in *Routledge Handbook of Systems Thinking*, edited by Laura Cabrera Midgley, Derek Cabrera, Routledge, vol. 20, 2021.
- [2] D Cabrera and L Cabrera, *Systems Thinking Made Simple: New Hope for Solving Wicked Problems in a Complex World*. Odyssean Press, Odyssean Press, Ithaca, 2015.
- [3] D Cabrera, et al., “A Unifying Theory of Systems Thinking with Psychosocial Applications”, *Systems Research and Behavioral Science*, 2015.
- [4] D Cabrera, et al., “The Four Waves of Systems Thinking”, in *The Routledge Handbook for Systems Thinking*, edited by D Cabrera, et al., Routledge Press, London, UK, 2022.
- [5] Lau R, Anderson D, Redlawsk, “An Exploration of Correct Voting in Recent US Presidential Elections”, *JSTOR*, 2008.
- [6] Center For Election Science, “The Spoiler Effect”, , 2020.
- [7] Andrews E., “Media Consolidation Means Less Local News, More Right Wing Slant”, *Stanford Business School*, 2019.