VOTING BUDDY

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Voting Buddy: Helping to Foster Informed and Engaged Voters

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Abstract

Voting Buddy (votingbuddy.com) was launched during the 2022 election cycle to help voters with their decision-making. The tool asks users five "Myers Briggs" style questions related to political ideology. The five questions include an overview question, and more detailed questions regarding sentiments towards non-Americans (domestically and abroad), social welfare and fiscal policy, social policy, and industrialization and corporate policy. The tool then provides textual and graphical assessments of each user and matches each user with like-minded politicians/candidates. The tool can match users with politicians/candidates nationwide or within Congressional voting districts based upon user provided zip codes. Prior to the 2022 election, Voting Buddy was preloaded with assessments of all U.S. Senators and Representatives and all of their opponents (including third party and non-affiliated candidates). Because Voting Buddy's core team includes political scientists, educators, and engineers, Voting Buddy's algorithms, assessments, and comparisons were all found to be impartial by Voting Buddy users (voters and news media). The proposed paper will discuss Voting Buddy's role to date in helping to foster an informed and engaged voting public. Examples include Voting Buddy's use at voter registration events to engage voters, engaging first-time voters (high school/college students) with Voting Buddy, etc. In addition, the paper will discuss ways that Voting Buddy can be used in the future to inform and engage the voting public. This discussion will also project the election-related implications (related to turnout, voters more confidently participating in the election process, etc.) if Voting Buddy is successful.

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1. Introduction: Problem Statement

1.A. General Election Problems

Politics today does not seem to work for voters, political candidates, or our country. Campaigns are increasingly polarizing; information transparency is declining; and there seems to be a growing separation between politicians and constituents. [Note: Because of Voting Buddy's strong track record of objectivity, these claims shall remain unsubstantiated so that no politician or campaign is cited unfavorably.] As a result, some individuals that participate in the voting process cast votes that are uninformed or misinformed,[1] and other individuals have grown apathetic and do not vote at all.[2] [3] [4]

Quantifying the number of uninformed and misinformed voters can be challenging. However the number of nonvoters can be quantified and contextualized more accurately. According to the U.S. Census Bureau, the U.S. adult citizen population was 231,593,000 in November 2020.[5] Therefore, there were approximately 230M voting aged Americans at the time of the 2020 general election. Of these 230M individuals, 168,308,000 were registered to vote; 25,782,000 were not registered to vote; and the status of the remaining 37,503,000 was unknown. [6] Therefore, only 73% percent of American adults are known to be eligible to vote.

Of these 230M individuals, only 158,429,631 votes (68%) were cast for President.[7] With respect to the 38M individuals whose voter registration status was unknown, considering the two extremes (extreme 1, that none of these individuals were registered, and extreme 2, that all of these individuals were registered), then the total number of registered voters actually ranged from 168,308,000 to 205,811,000. Therefore, between 77% and 94% of registered voters actually voted for President in the 2020 election. Although these percentages may seem high, the fact remains that nearly one-third of the voting-aged American population (73,163,369) did not participate in the election. To put this number into context, the number of voting-aged Americans who chose not to vote for President is approximately 1% less than the number of Americans who cast votes for Donald Trump.[8]

1.B. Primary Election Problems

Aggregated national totals and percentages for primary elections are difficult to calculate because a) primary elections are administered on a state-by-state basis, and no aggregated "popular vote" totals are tabulated nationally; and b) various states have differing rules regarding primary election participation, but primary elections are generally limited to voters affiliated with certain political parties. But trends indicate that voter participation in primary elections is significantly lower than the participation in general elections.[9] According to the statistical data platform, Statistica, when considering all states (and the District of Columbia) that administered primaries in 2020, the maximum voter turnout was 45.7%.[10] The median and the mode voter turnout percentages were both approximately 20%.[11] Statistica also reported that eight states had a turnout lower than 10%, five states had turnouts lower than 5%, and the lowest turnout recorded was 2.6%.[12] These numbers translate to customary nonparticipation rates of 80% and a maximum nonparticipation rate of 97.4%.

A study coauthored by Yale University, University of California, Riverside, and the London School of Economics suggests that potential voters are not socialized to participate in primary elections.[13] The study also suggests that potential voters do not feel that they are knowledgeable enough toad value to the process; in other words, they feel uninformed.[14]

1.C. State and Local Election Problems

There are over 18,000 state elected officials and over 500,000 local elected officials in the U.S.[15] Even though these individuals are seated incumbents, several of these politicians are not well known and have poor name recognition.[16] Of course, this also presents a challenge for the opposing candidates who are less known since they do not have the benefit of incumbency. These situations lead to multiple problems. First, research shows that voters tend to lean heavily on name recognition when making political selections – if voters recognize the name of a politician, they are more like to vote for that politician, even if that politician has views that are not consistent with the voters' views.[17] [18] Another undesirable consequence is that voters tend to make their political selections based on factors other than what they know about the specific individuals running for office.[19] The net effect of this situation is that the views and priorities of the elected local politicians may differ from the views of the constituent that they represent.

1.D. Cross Cutting Problems

Some problems are common across all election paradigms. For example, especially in cases after Congressional Districts are redrawn, some voters do not know the names of the candidates that are available to them.[20] The risk of this occurrence is specifically acute in densely populated areas where multiple districts overlap the same media markets. In the Washington, DC area for example, local television and radio stations provide coverage to multiple Congressional Districts in Maryland and Virginia. Therefore, when a voter in this media market sees or hears a political advertisement for a particular Congressional Representative, it is quite possible that the Representative is not even available to the voter.

1.E. Other Problems

There are other, less documented problems related to the way that politics is administered today that are separate and distinct from the well documented primary and general election problems.

1.E.i. A Lack of Interactive Communication between Politicians and Constituents

One problem is that there is no universal pathway or platform for politicians and the constituents that they serve to interactively communicate. Of course, many politicians have made themselves available to their constituents for interactive input and feedback. However, of these politicians that have made themselves available, the pathways that ultimately lead to accessibility and the levels of accessibility tend to vary greatly; and despite the pathways that may exist, some of these pathways are unknown or are not well understood by constituents. In some cases, the procedures that are outlined to gain accessibility simply do not work at all.

1.E.ii. Politicians Lack Knowledge regarding Their Constituencies

Another problem, which tends to be a secondary problem related to the lack of communication with constituents, is that some politicians do not know the will of their constituents. Some politicians lack a broad (ideological) knowledge regarding the will of their constituents. Beyond the coarse ideological labels (e.g., "Conservative" or "Liberal"/"Progressive"), these politicians lack understanding related to the texture of these ideological leanings of their constituents (e.g., "moderately conservative on social issues, but solidly liberal/progressive on fiscal issues"; "centrist regarding national security related issues, but solidly conservative regarding issues related to businesses and corporations", etc.). In addition, some politicians do not know the will of their constituents in near real time on specific topics of interest (e.g., "Do my constituents understand the meaningful factors related to the bill that is being considered?"; "Do my constituents support or oppose the bill under consideration?"; etc.).

1.E.iii. Constituents Struggle to Articulate Where They Stand

In some cases, the terminology and vernacular that constituents use to describe themselves ideologically vary and may not accurately communicate their true positions to politicians. For example, some constituents might use the terms "moderate", "centrist", and "independent" to describe themselves. However, their elected officials might understand these terms differently. As a result, even in cases where constituents and their elected officials communicate, it is possible for the politicians to come away with an understanding that is different from what the constituents intended.

1.E.iv. Constituents Struggle to Contextualize Where They Stand

Of course, if constituents describe themselves using inconsistent language, then it is difficult for any individual constituent to be contextualized in terms of fellow constituents. In other words, some constituents may not know if their ideological views are within the statistical norms related to their fellow constituents, or if their views are outliers. (Certainly, Voting Buddy does not encourage or discourage constituents to normalize their views to be consistent with their constituent peers. However, Voting Buddy does believe that there is value in understanding whether a viewpoint is consistent with peer viewpoints, or if the viewpoint is an outlier.

1.E.v. Polarization

The combination of these problems (the lack of communication between politicians and constituents; the difficulty constituents have articulating their points of view; and problems related to these factors) seems to serve as contributors to the political polarization that seems to characterize politics today. Instead of communication that leads to understanding, the lack of communication and the general misunderstandings tend to degenerate towards political tribalism – which seems to cyclically lead to less communication and continued misunderstandings.

1.E.vi. Limited Supports Available for Certain Mobile Voting Populations

Certain limited subsets of the U.S. population are allowed to engage in mobile voting. These populations include deployed, active-duty members of the military; certain categories of disabled persons; etc.[21] Because these populations are outside the norm and politician data are not regularly marketed to them, it can be difficult for these populations to know the ideologies and positions. Therefore, these populations are often relegated to selecting politicians without really understanding their platforms or knowing their stances on particular issues.

1.F. The Consequence of the Problems

Each of the above problems contributes to unhealthy symbiotic political and election ecosystems. In general, many in the voting public feel disaffected and do not believe that their participation in the voting process will lead to sufficient positive change in their lives and/or in the context of issues that are important to them; and as a result, they do not vote. Some individuals vote, but due to the lack of information or misinformation driving their votes or the votes of others, the voting results are not universally accepted to represent the will of the people. Others simply do not trust the intentions of the political process and/or the politicians representing them. The resulting unhealthy political and election ecosystems lead to an erosion of a foundation component of American society. Instead of unifying Americans, the net result is a system that does not seem to work for voters, political candidates, or our country.

2. Voting Buddy as a Solution

Voting Buddy is intended to improve the election experience in a way that enables the political process to better meet the needs of voters, politicians, and our country. As a result of the intentional and painstakingly systematic methodology that has been used to develop Voting Buddy, the tool has iteratively built upon its successes while remaining true to core values of objectivity and user-friendliness. This development process is detailed Figure 1 and in the sections that follow below.

VOTING BUDDY PROGRESSION OF FEATURES

	VERSION 1	VERSION 2	VERSION 3
RELEASE (PLATFORM)	2021 (website)	2022 (website)	coming 2023 (website, iPhone & Android apps)
SELF ASSESSMENT	yes	yes	yes
COMPARISONS DATABASE	no	all 1,300 Senate/House incumbents/candidates	all 1M national, state, & local incumbents/candidates
ANONYMIZED DATA AGGREGATION	no	basic	advanced (age, race, ideology, education, income, etc.)
PLUS	N/A	N/A	interactive voter-politician communications; virtual town hall meetings; politician donations

www.votingbuddy.com

Figure 1: Voting Buddy Progression of Features

2.A. The History of Voting Buddy

2.A.i. Voting Buddy, Version 1

Voting Buddy, Version 1 was released in the spring of 2022. This version of Voting Buddy introduced the user self-characterization feature. See Figure 2.

2.A.i.a. Voting Buddy's Questions

In an effort to systematize the administration of Voting Buddy and to make Voting Buddy user-friendly, instead of asking users numerous questions, Voting Buddy, Version 1 asked users only five questions. These questions are best described as objective "Myers Briggs" style questions related to political ideology. The five-question quiz format was much shorter than other similar quizzes.[22][23][24] Most users completed the quiz in under five minutes. Anecdotal feedback from users suggested that the brevity of Voting Buddy's quiz encouraged its use.
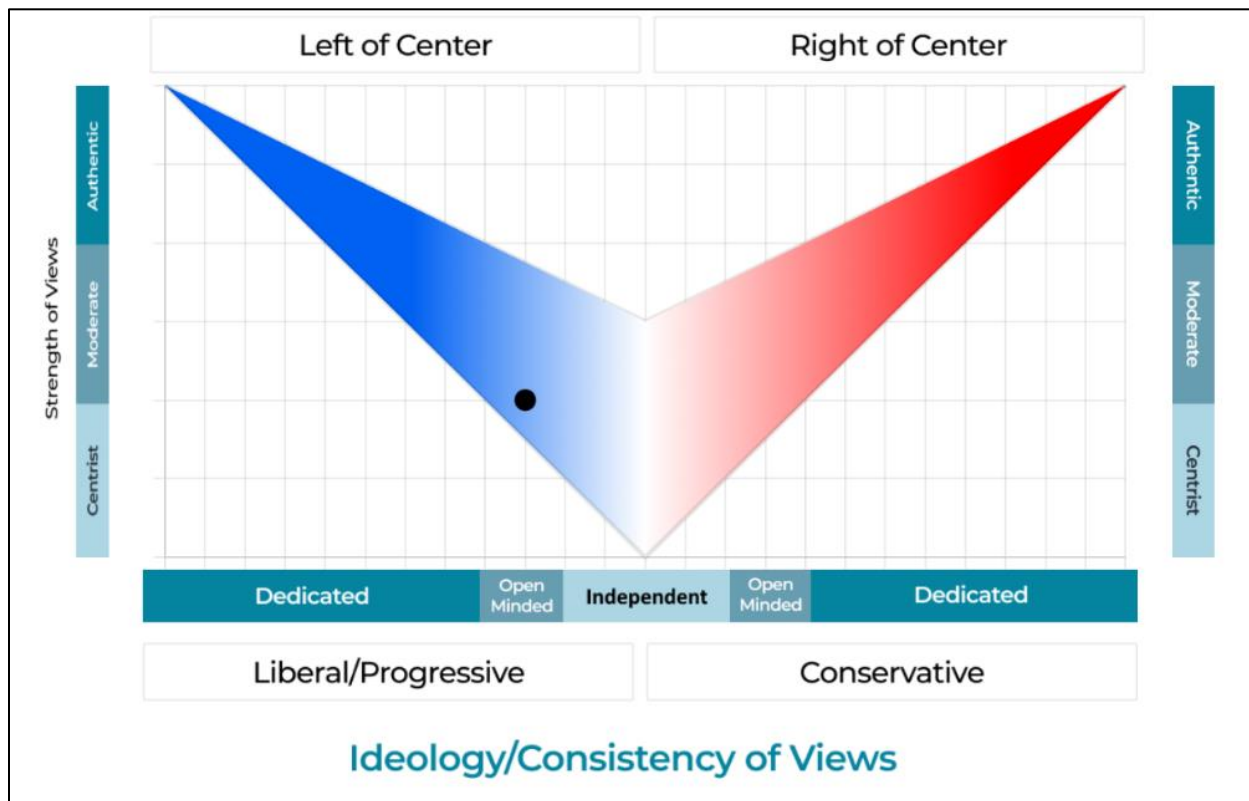
Figure 2: Ideological Map Output of Voting Buddy, Version 1

The five questions included an overview question, and more detailed, topical questions regarding sentiments towards non-Americans (domestically and abroad), social welfare and fiscal policy, social policy, and industrialization and corporate policy. The overview question asked how much users cared about certain political issues, and the topical questions enabled users to define where they stood on those issues. Despite the brevity of the Voting Buddy quiz, it touched on a wide range of topics including:

- Foreign Policy
- National Security
- Immigration
- Military Issues
- Diplomacy
- Immigration
- International Affairs
- International Alliances

- Fiscal Policy
- Social Welfare Policy
- Medicare/Medicaid
- The National Debt
- Welfare
- The Deficit
- Entitlement Programs
- Taxation

- Social Policy
- Abortion (Pro Choice/Pro Life Issues)
- Social Justice
- LGBTQ+ Issues
- Religious Freedoms
- Cannabis Policy
- The Death Penalty

- Corporate Policy (Regulatory and Oversight Issues)
- The Protection of Resources
- Environmental Policy and Climate Change
- Energy Policy
- Union/Labor Policy
- Federal Subsidies

The Social Policy question is included below as a representative example.

Topic 3: Social Policy
Instructions: Choose how much you agree with each set of viewpoints.
Left of Center Viewpoint:
- Our values should represent the culture/demographics of today.
- In addition, I believe that groups that have historically been marginalized and disenfranchised should receive equity and empowerment.

Centrist Viewpoint:
- I consider myself to be a centrist on social issues.

Right of Center Viewpoint:
- Traditional values have served us well and should remain intact.

In case some aspects of the questions were not understandable to the users, users could request additional clarification, and Voting Buddy would offer some statements that could be characteristic of the Left of Center and Right of Center viewpoints. The statements were provided as a sampling that were not all-encompassing. The Left of Center and Right of Center viewpoints are included in Figure 3 below.

Left of Center Possible Statements   Right of Center Possible Statements

A person who supports this column might also say:	A person who supports this column might also say:
- I oppose the death penalty. - I support same-sex marriage - I support a woman's right to choose. - I do not believe that guns should be available for purchase. - I support embryotic stem cell research. - I believe that the main problem related to police is abuse of power. - I believe in the separation of church and state.	- I am pro-life. - I support traditional marriage (between a man and a woman). - I support the death penalty. - I believe that I should be able to possess a gun. - I do not support embryonic stem cell research. - I believe that the main problems related to police is a lack of empowerment and a lack of the support needed to do their jobs. - I do not believe that my religious beliefs and my political beliefs should have to be separated.

Figure 3: Left of Center and Right of Center Possible Statements embedded within Voting Buddy Topic 3

2.A.i.b. Voting Buddy's Algorithms and Factors related to Other Internal Workings

Voting Buddy's proprietary algorithms incorporated both "how much users care" about issues and "where users stand" on those issues. Therefore, even if two users had the exact same stance on certain issues, if there was a difference in how much each user cared about one issue or another in particular, then the two users will generate different self-assessments. The algorithms

were developed and rigorously vetted by MIT research staff over a ten-year period and were validated as being objective and accurately assessing user inputs.

Normally, ideological quizzes offer two choices for each question (e.g., right vs. left; liberal (or progressive) vs. conservative, etc.). Voting Buddy was different in that it offered over one thousand possible answers per question. Because Voting Buddy offered such a high level of specificity with possible answers, Voting Buddy's five questions generated ~10^{15} possible outcomes. This reduced the likelihood that two or more users would generate the exact same results, and ultimately highlighted the value of each individual user's unique perspective.

2.A.i.c. Voting Buddy's Graphical Assessments

The ideological profile is the main output generated by Voting Buddy. After Voting Buddy processes all of user data inputs, this profile summarizes user results in (what is normally) a three-word phrase. This output makes for easier groupings and categorizations. The ideological profile describes users' temperaments in terms of three metrics:
- users' ideological leanings
- the strength of users' ideological perspectives, and
- the consistency of users' ideological perspectives.

There are three possible outputs to describe users' ideological leanings:
- Liberal/Progressive
- Independent
- Conservative

"Liberal/Progressive" is the output if users' overall ideological leanings are to the Left of Center. (Note: Voting Buddy understands that there are differences between the liberal and progressive ideologies, but when considering these differences in terms of the Left of Center, Center, and Right of Center options, both are best characterized as being Left of Center.) "Conservative" is the output if users' overall ideological leanings are to the Right of Center. "Independent" is the output if users have no ideological leanings whatsoever (i.e., users Left of Center and Right of Center leanings are exactly equal).

There are three possible outputs to describe the strength of your ideological perspectives:
- Centrist
- Moderate
- Authentic

"Centrist" corresponds to ideological perspectives that are not particularly strong. "Authentic" corresponds to strong ideological perspectives. "Moderate" corresponds to ideological perspectives that are in the middle (i.e., in between "Centrist" and "Authentic").

There are three possible outputs to describe the consistency of your ideological perspectives:
- Independent
- Open-Minded
- Dedicated

"Independent" corresponds to ideological perspectives that are rather variable (i.e., the Left of Center perspectives and the Right of Center perspectives are almost equal). (Note: When "Independent" is used in terms of ideological leaning (earlier in this section of the document), it corresponds to views that are absolutely in the middle. When "Independent" is used in terms of ideological consistency (here), it is a descriptor that characterizes how far to the Left of Center or the Right of center users are; so, in this case, the left and right ideological perspectives do not have to be exactly equal. Although this concept may be confusing, it should make more sense when results are observed plotted on the graph.)

"Dedicated" corresponds ideological perspectives that tend to be consistently to the left of center or consistently to the right of center for all of the topic areas.

"Open-Minded" corresponds to an ideological consistency that is in the middle (i.e., in between "Independent" and "Dedicated").

The Ideological Temperament is illustrated more clearly as graphical output in Figure 4. It is interesting to note that Voting Buddy uses a proprietary algorithm to display the three independent variables (the right, center, and left options available for each of the topical questions) in a two-dimensional plot. Voting Buddy is pursuing a patent for this capability.
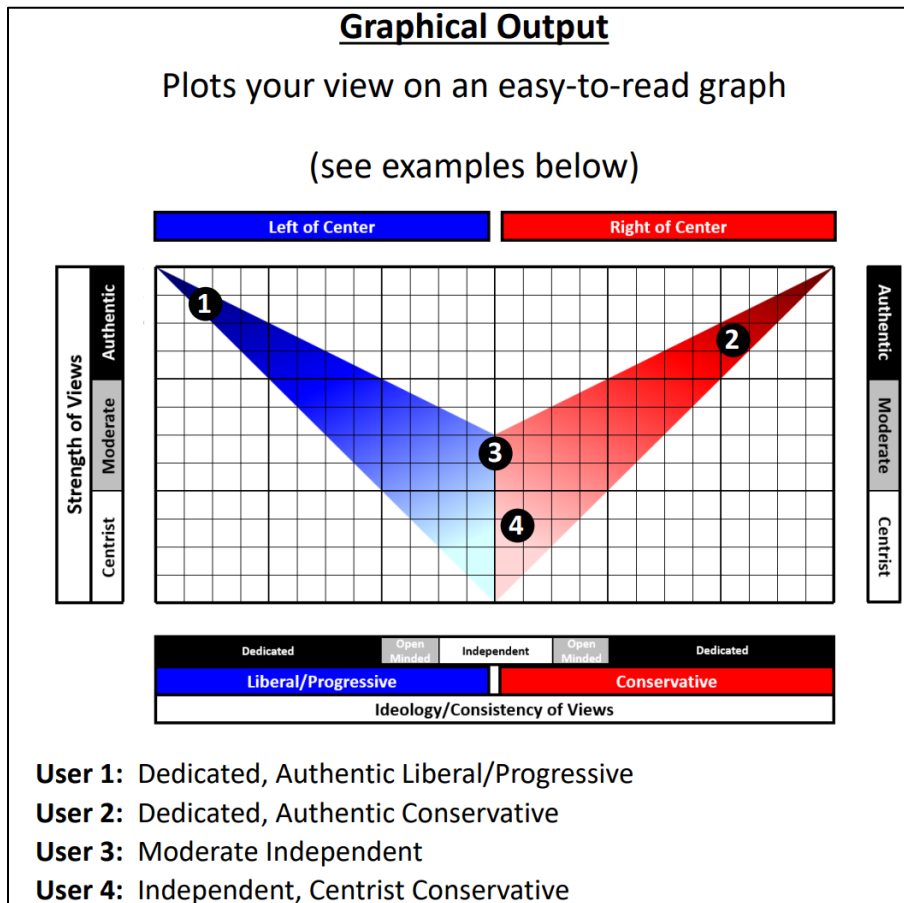

Figure 4: Voting Buddy Ideological Temperament Graphical Assessments

The colorized portions of the graph represent the logically plausible (and mathematically possible) outputs. For example, considering the non-colorized, top center portion of the graph, it is not logically plausible (and mathematically impossible according to Voting Buddy's algorithms) to have a user whose views are characterized as being strong conservative views, or whose views are characterized as being strong liberal views, and describing the user's views as being "Independent". Similarly, considering the non-colorized, lower right and lower left portions of the graph, it is not logically plausible (and mathematically impossible according to Voting Buddy's algorithms) to have a user who is best described as a Dedicated Liberal/Progressive, or who is best described as a Dedicated Conservative, with views that are overwhelmingly characterized as being "Centrist".

2.A.i.d. Voting Buddy's Textual Assessments

In addition to the graphical representation of Voting Buddy's assessments, Voting Buddy also provides users with detailed textual assessments. The intent of these assessments is to be informative and to describe users as objectively as possible. These assessments begin with overview assessments and progressively drill down into more detail.

The overview assessments begin by describing users' defining ideologies (e.g., users are ideologically to the left of center; users are ideologically to the right of center; etc.) and follow with a more nuanced description (e.g., very much to the right of center; somewhat to the left of center; slightly to the right of center; etc.). The assessments then report the results of the statistical analysis of the fluctuation/consistency of the users' results and also the overall strength of the users' views. Finally, the assessments provide overall user characterizations that match the two-word or three-word characterizations that accompany the graphical assessments.

After the various factors related to the overview assessments have been addressed, assessments related to each of the four topical areas are provided. Assessments are provided related to how important each of the topical areas are to the users; Voting Buddy also characterizes the substance of the users' views. It is through these substantive characterizations that various terms and phrases are introduced (e.g., "hawk", "dove", "fiscal conservative", etc.). These topical results conclude with a shorthand notation summary of each of the four topical area assessments. A representative example of a textual assessment is shown in Figure 5.

In general, your defining ideology is best characterized as being to the ideological right. Considering your views at a deeper level, your ideology is very much to the right of center.

Looking at the fluctuation of the strength of your views within your defining ideology, your views are best described as being somewhat consistent. The strength of your views is moderate.

Considering all of these factors together, in light of the fact that your conservative views are so much stronger than your liberal/progressive views, you are best described as being a dedicated, moderate conservative.

The evaluation that follows reports your perspectives on a more detailed level. Issues related to national security, immigration, and foreign policy seem to be very important to you. Based on your perspectives regarding these issues, you are best described as being a hawk -- a person who tends to be more conservative on national security, foreign policy, and immigration issues. Issues related to fiscal policy and social welfare seem to be less important to you. Based on your perspectives regarding these issues, you are best described as being fiscally conservative. Issues related to social policy seem to be less important to you. Based on your perspectives regarding these issues, you are best described as being a social conservative. Issues related to corporate policy and the protection of environmental/human resources seem to be very important to you. Based on your perspectives regarding these issues, you are best described as being a centrist regarding economic, labor, and environmental matters. As a result of these perspectives, your four-character profile is $R^+R^-R^-C^+$ (L=Left, C=Center, R=Right).

Figure 5: Representative Example of Voting Buddy Textual Assessment Language

2.A.ii. Voting Buddy, Version 2

Voting Buddy, Version 2 was launched in October 2022, shortly before the 2022 midterm elections that were held in early November 2022. The main thrust of Voting Buddy, Version 1 was the "Myers Briggs" style user self-assessment. Although Version 2, the version that is currently available at www.votingbuddy.com, incorporates advancements in the administration of the quiz and in the self-assessment results display, then main improvement with Version 2 is that Version 2 enables the aggregation and the comparison of input data. Therefore, users can see how their views compare to other user populations, and users can compare their views with the views of incumbent and candidate politicians.

2.A.ii.a. Improvements in the Administration of Voting Buddy's Quiz

Version 2 does not introduce any changes to Voting Buddy's questions or in the Right of Center/Left of Center information boxes available. The main difference is that users are able to enter their results simply by moving the "slide bar", and keystrokes are no longer required. The slide bar user input feature is shown in Figure 6.
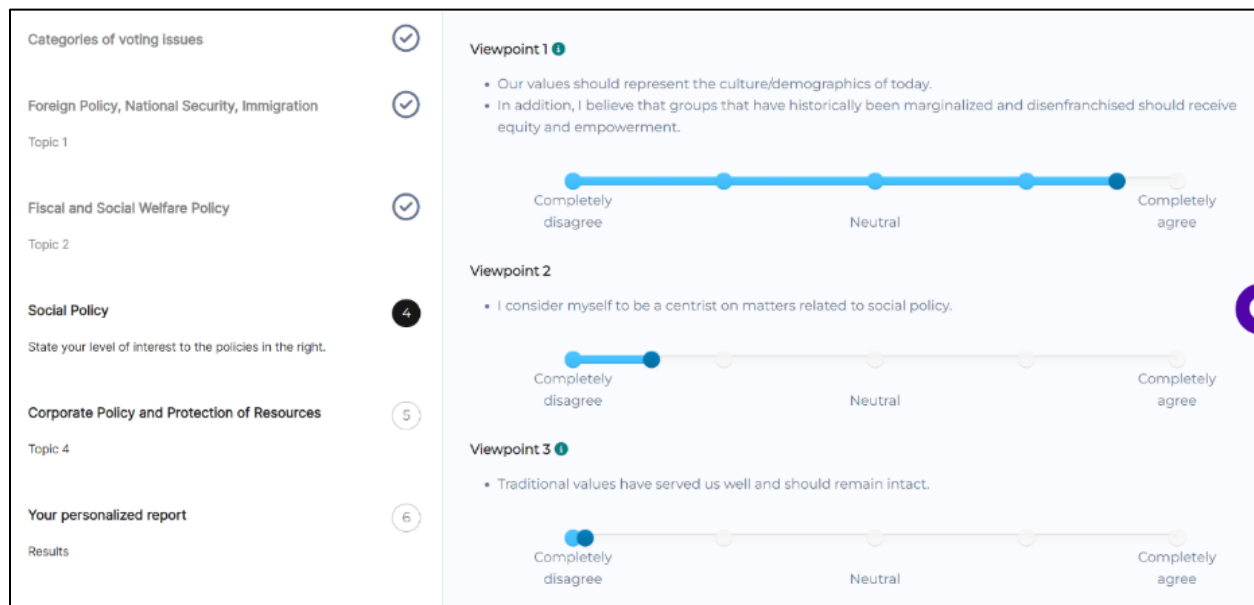
Figure 6: Slide Bar Data Input Feature within Voting Buddy, Version 2

Considering the internal workings of Voting Buddy, the tool enables more granularity in user data inputs. Therefore, instead of Version 1's over one thousand possible answers per question, Version 2 offers over 600,000 possible answers per question. As a result, instead of Version 1's ~10^15 possible outcomes, Version 2 offers ~10^31 possible outcomes. It is interesting to note that this number of possible permutations is orders of magnitude greater than the number of stars in the universe, plus the number of grains of sand on all of the earth, plus the number of ants on earth.[25] [26] [27] [28] [29]

2.A.ii.b. Voting Buddy Insights: Aggregating Data from Various User Populations

Version 2 introduces the ability to anonymize and aggregate user inputs for statistical analysis purposes. Voting Buddy can correlate anonymized user responses with user provided zip codes to provide statistical data regarding ideological sentiments across the U.S. as a whole or in specific geographic regions of the U.S. In near-real time, users can identify where their ideological sentiments fall within the distribution of sentiments across the U.S. population, or within specified regions of the U.S. An example of this insight display is shown in Figure 7.
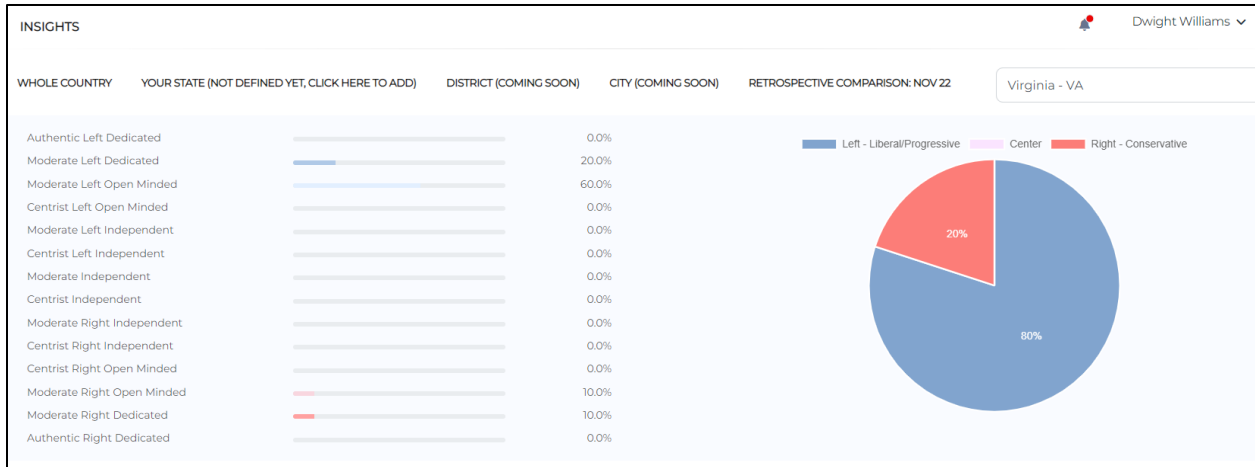
Figure 7: Near-Real Time Statistical Data Insights using Live Data from Users based in the Commonwealth of Virginia

2.A.ii.b. Voting Buddy Politician Comparisons

Voting Buddy, Version 2 enables users to compare their results with the verified or estimated results of politicians (both candidates and incumbents). Like the self-assessment algorithms, Voting Buddy's proprietary politician comparison algorithms compare both "how much each user cares about a topic" vs. "how much the politician compares about the topic" and "where each user stands on a topic" vs. "where the politician stands on the topic". Therefore, even if a user and a politician have the exact same stance on certain issues, if there is a difference in how much the user and politician care about one issue or another in particular, then the user and politician will generate different comparison scores. The comparison algorithms were developed and rigorously vetted by MIT research staff over a ten-year period and were validated as being objective and accurately comparing users and politicians.

Figures 8, 9, and 10 illustrate some key aspects of the politician comparison features. The extended example below will compare the results of an arbitrary Right of Center user (Figure 8) with entries for incumbent Representatives in the state of Pennsylvania (Figure 9). (Of course, the users could compare their results against all politicians nationally; against politicians that are currently representing them (in the House and Senate); against all politicians that were vying for their votes in the November 2022 election; etc.)

It is interesting to note that even though the user position on the V Chart seems to be similar to the positions of Scott Perry and Glenn Thompson, it is Dan Meuser that is identified as most similar. Although Representatives Perry and Thompson might have views that are similarly moderate when compared to the user overall, it is likely that differences exist topic-by-topic. In other words, the user may be more moderate on fiscal issues, but not social issues; and Representatives Perry and Thompson may be more moderate on social issues, but not fiscal issues.
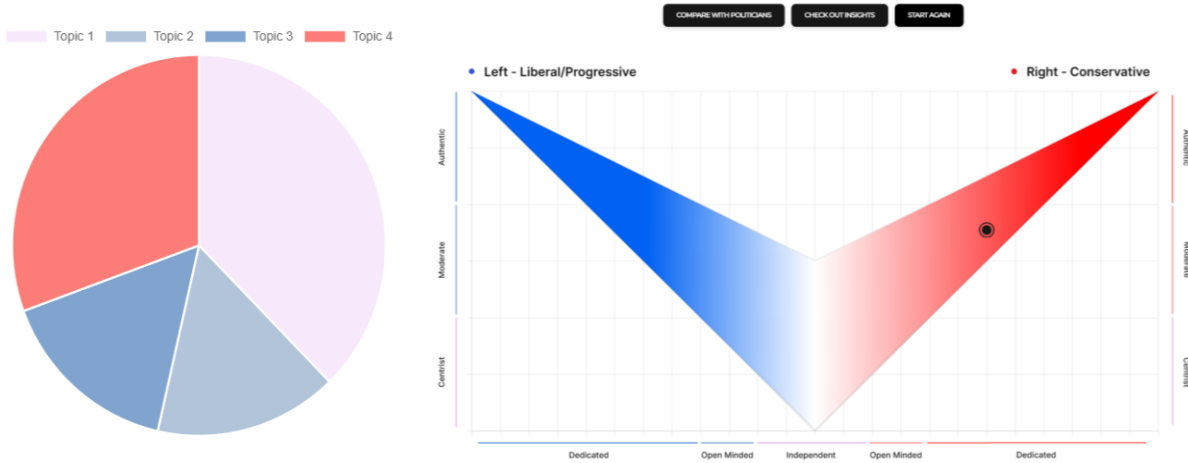
Figure 8: Topical Weightings and V Chart for Arbitrary Right of Center User

Figure 9: Voting Buddy Comparison Feature Showing Sampling of Incumbent Pennsylvania Representatives

Figures 10 and 11 show the detailed comparison pages (that appear when the politician's name is clicked) for Representative Meuser (ranked #1 as the most similar compared to the user) and Representative Kelly (ranked #5 as somewhat similar compared to the user).

The header information on these comparison pages lists the politician's name, website, contact information, political party affiliation, total expenditures in dollars, and information regarding the next election date for this politician's seat, voting locations in this politician's district, voting methods that are available, and voting requirements. The header information also has a button that enables users to donate to the politician. (What this means is that a user with no knowledge of the candidates can use the Voting Buddy tool, get matched with a politician, and donate to that politician in near-real time.) The comparison information is shown below.
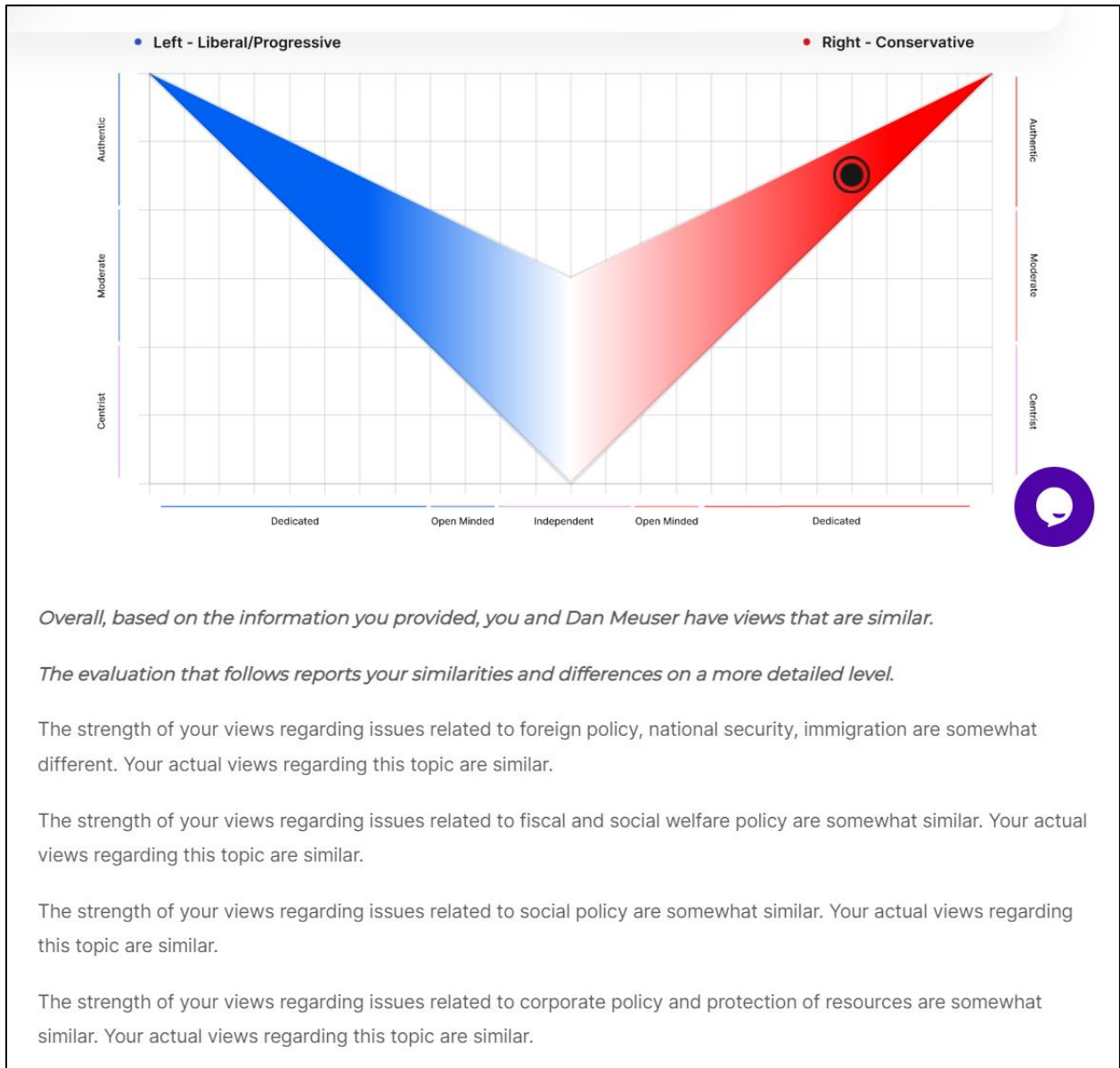
Figure 10: User Comparison with Representative Meuser, Assessed to be Most Similar to the User
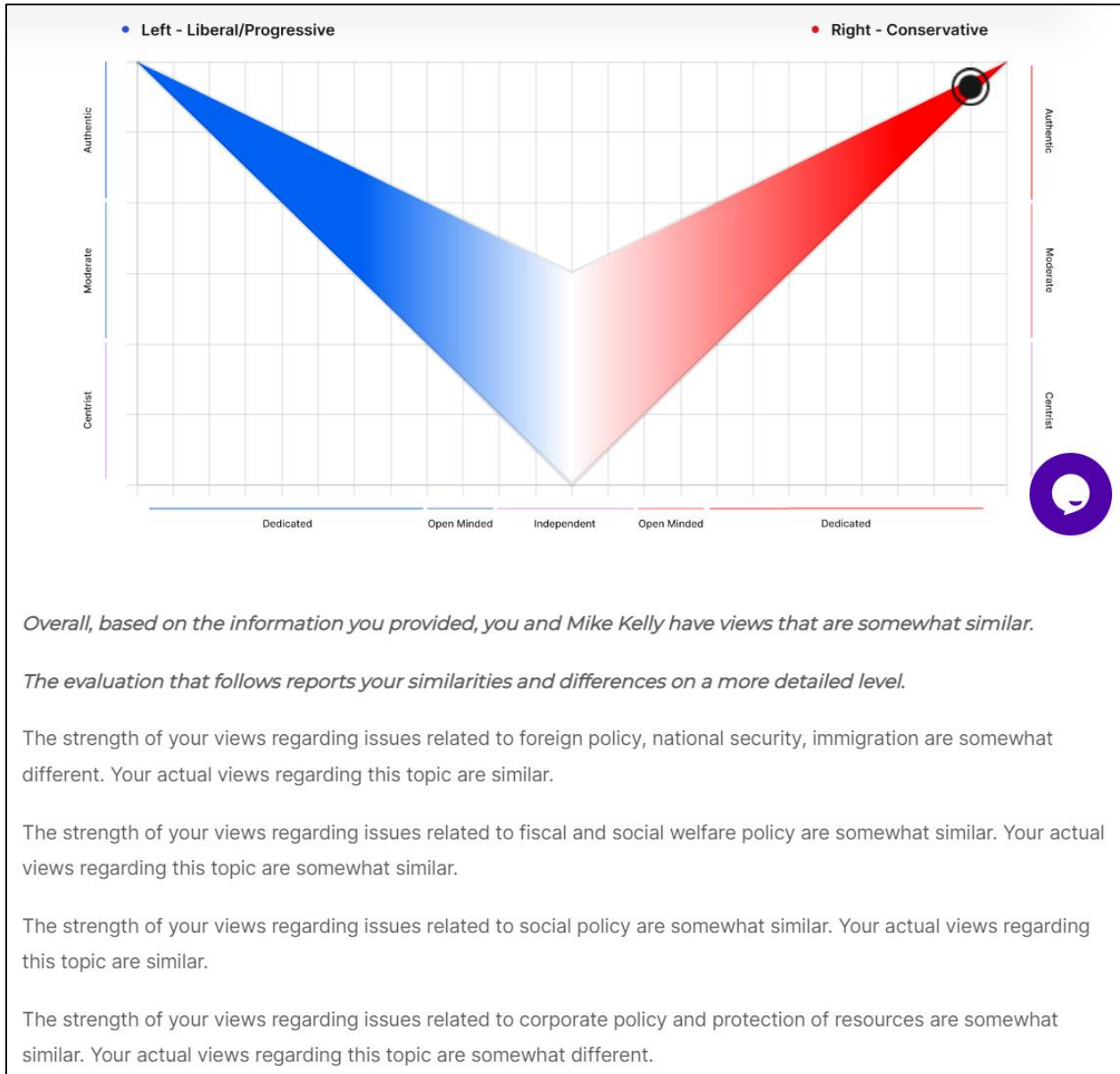
Figure 11: User Comparison with Representative Kelly, Assessed to be Somewhat Similar to the User

For the initial launch of Voting Buddy, the politician data that were used to develop Voting Buddy's politician database of estimates were aggregated and evaluated by individuals at partner academic institutions including the Massachusetts Institute of Technology, the University of Maryland, Howard University, Frostburg State University, and North Carolina Central University. The politician estimates were derived from their speeches, interviews, campaign websites, etc. Voting Buddy estimates were generated for all 1,300 individuals running for election (and re-election) in the House and Senate. These estimates included all politicians from all political parties and affiliations -- Democrats, Republicans, Libertarians, Independents, Non-Affiliated Candidates, Write-Ins, etc. Moreover, these estimates included politicians from every state and U.S. Territory (including Puerto Rico, the U.S. Virgin Islands, etc.). In other words, every politician running for the House and Senate with sufficient data evaluate was included in Voting Buddy's preloaded politician comparison database. (In approximately two percent of the

cases, the information that was found was insufficient to generate a politician estimate. In these rare instances, the Voting Buddy team decided that it was better to exclude these politicians from the Voting Buddy database so that the pedigree of the estimates was not compromised with incomplete information.)

By all accounts, Voting Buddy, Version 2 was an incredible success. In less than one month, the website received over 20,000 page views. No money was used to advertise Voting Buddy, and users/voters spread the word organically. In the brief amount of time Voting was available before the election, it was put to use in all fifty states and in U.S. Territories. Members of the public appreciated Voting Buddy's impartiality and user-friendliness. Members of the news media scrutinized Voting Buddy and found it to be objective and a positive addition to the political and election ecosystems. In addition, the politicians that reached out to Voting Buddy indicated that the Voting Buddy estimates were indeed accurate. Of the over 20,000 page views and 1,300 politicians, no user, media personality, or politician found any inaccuracies or bias in any of Voting Buddy's algorithms or assessments.

2.B. The Future of Voting Buddy, Voting Buddy 3.0

2.B.i. Introduction

Voting Buddy has received an overwhelming amount of positive feedback with respect to the current release -- Voting Buddy, Version 2. Many individuals suggested improvements they wanted to see in Voting Buddy. In general, all of the feedback involved expanding Voting Buddy's capabilities and features. The net result of this user feedback is Voting Buddy 3.0 that is scheduled to be released in the fall of 2023.

The main change in Voting Buddy 3.0 will be that, instead operating as a standalone website, Voting Buddy 3.0 will be a communications platform that gives voters and politicians the opportunity to interact with one another and a marketplace that gives voters the opportunity to donate to their favorite candidates. Because the vast majority of users accessed Voting Buddy via their cell phones, Voting Buddy 3.0 will be accessible as a mobile app available for free through the Apple App Store (for iPhones) and Google Play Store (for Android phones).

2.B.ii. Voting Buddy 3.0 Features of Interest to Voters

Users will enter into the Voting Buddy space via the same quiz that they have used for Version 1 and Version 2. (Supplemental quizzes will be available to users if they have a particular interest in certain areas.) Instead of comparing users to the 1,300 House and Senate politicians as in Version 2, Voting Buddy 3.0 will include every politician that is an incumbent is a challenger for every national, state, and local election (over one million politicians). As a result, when users complete their quizzes, Voting Buddy can present them with several options. For example, users can compare themselves with all of the national, state and local level incumbents representing them based on each user geographical information input into the system; or users can generate a complete personalized sample ballot based on each user/politician comparison result; or users can compare with all of the candidates running for a particular office; etc.

Because Voting Buddy 3.0 will be an interactive communications platform, for each politician in the Voting Buddy system, users will be able to click a "Contact Now" button to interactively connect with the politician or a member of the politician's staff (via instant message, audio call, video chat, etc.) in real time. Each politician will also have a "Donate Now" button so that users can donate to like-minded politicians if they choose. These features are in response to voters indicating that they want greater access to their elected officials and political candidates, and voters also indicating that they want a streamlined way to donate to like-minded politicians. As a result of the Voting Buddy system, a voter can take the quiz, find like-minded politicians at the national and down ballot levels, interactively communicate with those politicians, and donate to those politicians – all in a matter of minutes. A representative example of a politician page with these features is shown in Figes 12.
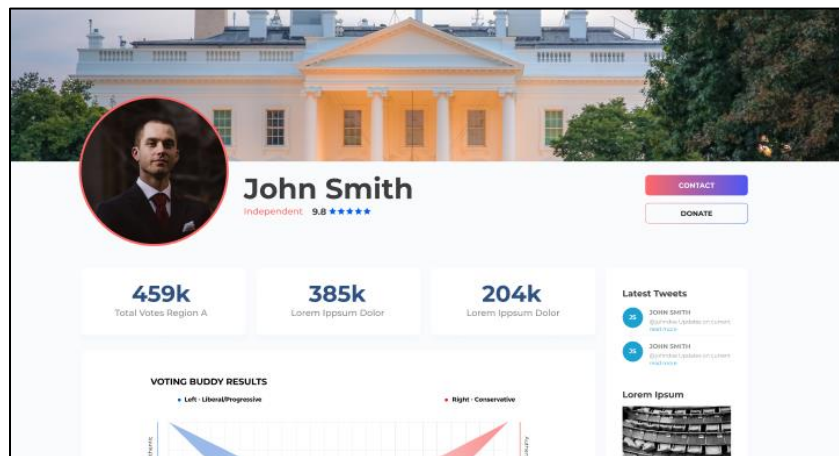
Figure 12: Representative Example of Politician Page with Donate and Contact features Enabled

2.B.iii Voting Buddy 3.0 Features of Interest to Politicians

The benefits to politicians will be valuable as well. First, Voting Buddy will enable politicians to passively attract engaged, like-minded supporters. This will be especially impactful for down ballot politicians with limited publicity budgets. A voter can use Voting Buddy with the intention of clarifying like-mindedness related to two or more national politicians, and Voting Buddy will also show the like-mindedness of the down ballot politician that would have otherwise not been known to the voter. In this way, Voting Buddy can serve as a tremendous asset to politicians.

Once Voting Buddy has connected to the voter and the politician, the politician will be in position to ask the voter (interactively) if the voter would like to help organize for the politician's campaign or donate to the politician.

Voting Buddy will be able to make enhanced data available to the politicians about the voters, if the voters agree. For example, if a politician is contacted by two like-minded voters, and the data show that one voter is a reliable voter, and the other voter participates in elections less reliably, then the politician is in a better position to target the outreach message to each voter. (To the reliable voting supporter, the politician may offer an opportunity to engage other

supporters; and to the less reliable voting supporter, the politician may simply emphasize the need for support at the ballot box.)

Anonymized statistical data will be made available to all politicians regarding ideological, demographic, and other trends within their voting districts. If a person running for mayor would like to know how many Black males in the city, between 50 and 60 years old, that are fiscally conservative and socially liberal, then Voting Buddy will be able to provide that information. Similarly, if a school board candidate wants to know how many college-educated, White females, between the ages of 25 and 35 years old live in the school zone, then Voting Buddy can provide that data. This capability will revolutionize the abilities of incumbent and candidate politicians to understand and better address the needs of their constituencies. A representative example of a politician page with the constituency demographics features enabled is shown in Figure 13.
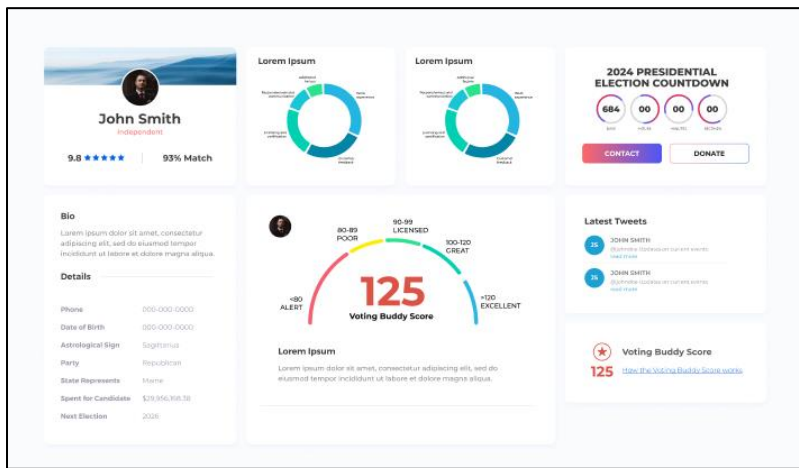
Figure 13: Representative Example of Politician Page with Constituency Demographics Features Enabled

A secondary benefit to politicians is that Voting Buddy will be able to log the contact information of like-minded voters that have connected with the politician. This information, coupled with the voter ideological and demographic information, leveraged in the context of Voting Buddy as a communications platform will enable politicians to host targeted town hall meetings that address highly targeted communities (e.g., a town hall meeting targeting like-minded voters in a politician's district who are socially liberal, high-school educated, union workers). A representative example is shown in Figure 14.
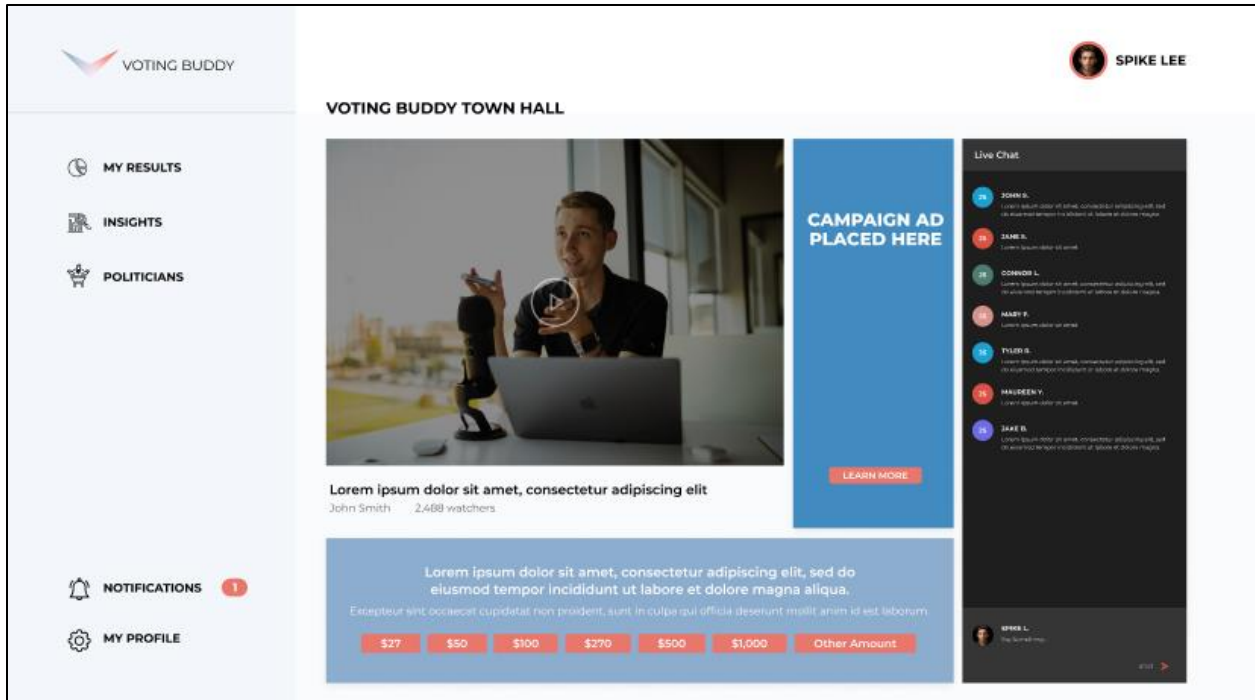
Figure 14: Representative Example of Politician Leading Targeted Town Hall Meeting of Constituents

2.B.iv. Voting Buddy 3.0 Features of Interest to Others

Voting Buddy will allow users to establish "Buddy Bunches" – subset communities with shared commonalities within Voting Buddy. For example, a public school system will be able to serve as a Buddy Bunch, and the individual high schools within the public school system could serve as secondary Buddy Bunches. This will enable high school children to learn about the political process, objective ideological self-assessment, and impartial politician comparisons in a safe environment. Voting Buddy can even be integrated into a high school government curriculum. It will also enable students to generate relevant political demographic reports within their schools.

Buddy Bunches can consist of families, colleges, friend groups, etc. The social aspect of the Buddy Bunches will make political discourse more enjoyable. It will also keep the American public engaged, and likely more prepared to positively contribute to the election process. A representative example of a family Buddy Bunch and an individual with several Buddy Bunches are shown in Figure 15 and 16.
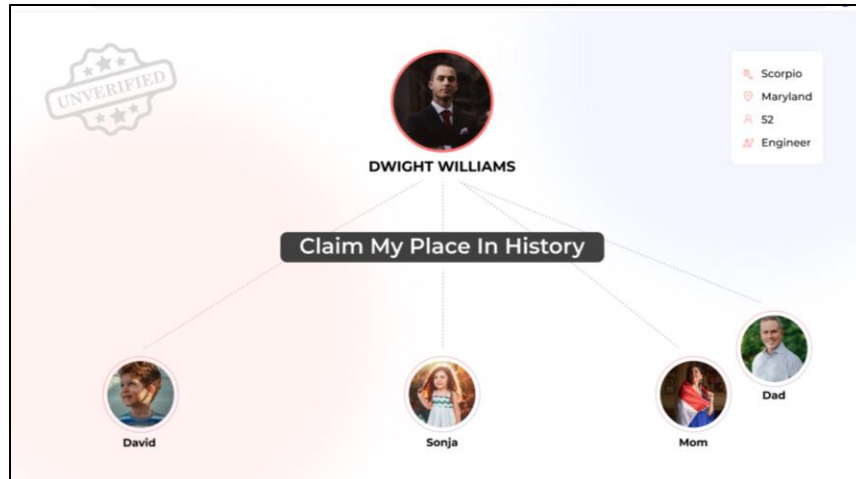
Figure 15: Representative Example of Family Buddy Bunch
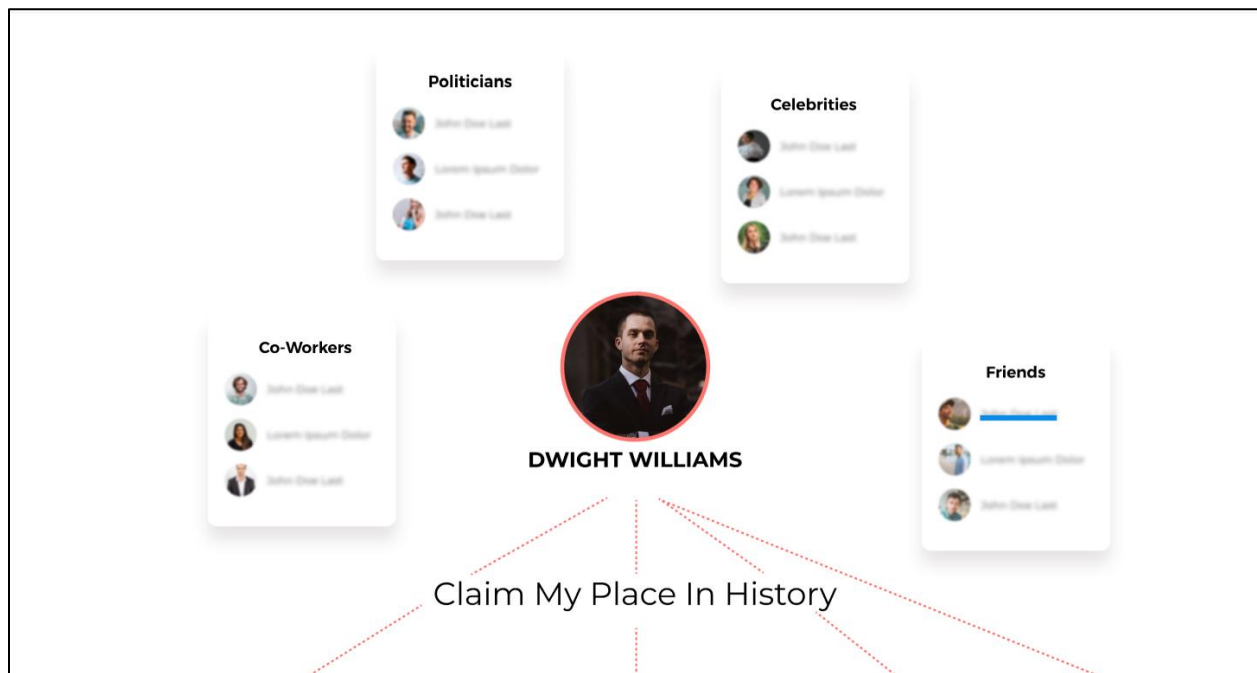
Figure 16: Representative Example of Individual with Several Buddy Bunches

Voting Buddy will also make standardized Buddy Bunches available to users. For example, one Buddy Buch could include all constituents of a particular voting district that are moderate fiscal conservatives. Another Buddy Bunch could include all constituents of a the same voting district that are dedicated doves in terms of national security. Because Voting Buddy tracks ideological stance and not political party, Voting Buddy expects that both Bunches will include Republicans, Democrats, and other political parties. Therefore, Voting Buddy will cross pollenate what currently devolves into tribalism by focusing individuals on their commonalities, and not their differences.

3. Conclusions

Many aspects of the political and election processes do not seem to work for voters, politicians, and our country. These problems include:
- General and Primary Election Problems
- State and Local Election Problems
- A Lack of Interactive Communication between Politicians and Constituents
- Politicians Lack Knowledge regarding Their Constituencies
- Constituents Struggle to Articulate and Contextualize Where They Stand
- Political Polarization
- Limited Supports Available for Certain Mobile Voting Populations

Voting Buddy was developed to address these needs. When fully developed, Voting Buddy 3.0 will serve as a revolutionary positive change that will shift the political and election ecosystems for the better.

Appendix I: A Detailed Consideration of the Candidate Data for the Comparison Tool

Voting Buddy was launched in its current form only weeks before the 2022 midterm elections. Because we were conducting an initial launch, and scalability was not a key concern at the time of the launch, we manually acquired and evaluated the data for all of the sitting and aspiring politicians that we characterized (~1,300 individuals total). Now that Voting Buddy is growing into an interactive communications platform that will be available to all 250M voting aged Americans; all 500K seated politicians (national, state, and local) plus their primary and general election opponents (which could add another 500K to 1M individuals); and 15M high school students (as near future voters and through school partnerships), scalability is an important factor. The way that Voting Buddy approached its data input in times past is not practical as Voting Buddy scales into a more comprehensive tool. Therefore, Voting Buddy is planning a different (more scalable) approach to its data input and data validation.

Voting Buddy plans to offer politicians/candidates the opportunity to register themselves and enter their own data . . . in the same way that users register themselves, take the Voting Buddy quiz, and thereby enter their own data. Enabling politicians/candidates to enter their own data solves the data entry scalability problem. Instead of a small Voting Buddy team attempting to generate estimates for all of the politicians/candidates – which would create a tremendous scalability bottleneck – voters will be able to essentially hear directly from the politicians/candidates as they speak for themselves through Voting Buddy. The Voting Buddy platform will provide equal voice to all politicians/candidates evenly.

This change in process introduces new challenges for Voting Buddy, but these new challenges are more solvable than the scalability challenge related to Voting Buddy's 2022 paradigm.

Challenge #1 involves verifying the identity of the politician/candidates entering the data. Given the vastness of the Voting Buddy politician/candidate data set, which is likely on the order of 1M individuals, there may be incidental cases where two (or more) politicians/candidates may share the same name. For example, New Jersey Senator, Robert Menendez, has a son who is also named Robert Menendez, who is a New Jersey Congressman. Voting Buddy will need an automated process that will distinguish between these two individuals with the same name. There also may be cases where a politician/candidate (or a supporter of a politician/candidate) might want to enter false information about an opponent in an effort to misrepresent the individual. Again, Voting Buddy will need a way to verify the identity of the individuals entering the information.

Voting Buddy is addressing this need in two ways.

- Voting Buddy is in the process of solidifying a partnership with the "Mobile Voting" platform. Mobile Voting is a platform that has officially been certified by election boards and is being used by servicemembers deployed overseas and certain disabled voter populations. Mobile Voting has agreed to allow Voting Buddy research its user identification protocols and even use portions of their code to validate identities with Voting Buddy. Therefore, Voting Buddy's ability to verify the identities of

politicians/candidates and users will have the robustness of the official mobile voting platform certified for use amongst populations in the U.S.

- Voting Buddy is also planning to verify user identities through a partnership with Aristotle, a company that has been addressing data and identity verification matters since 1983. Voting Buddy will imbed Aristotle APIs to enable the validation of the identities of the politicians/candidates and users.

Voting Buddy's partnerships with "Mobile Voting" and Aristotle will also facilitate optimized data processing so that the verification process occurs with minimal latency.

Once the identities of the politicians/candidates have been verified, Challenge #2 involves verifying that the positions that the politicians/candidates list are indeed their true positions. Voting Buddy plans to facilitate this data integrity issue using three pathways.

- Voting Buddy is planning to be released early enough to be used throughout the primary elections. Voting Buddy's use during the primary elections is important because a) primary elections tend to have more competitors that are more closely aligned in some cases, and b) it puts an early time stamp on each candidate's position. Because of the crowded field of closely aligned competitors, if a politician/candidate decided to intentionally present inaccurate data, while that may better position the politician/candidate with certain constituents, it will leave a void in the candidate's true ideological position – a void that will likely be filled by a competitor. This will strongly discourage intentional inaccuracies.

    For example, if Donald Trump (who is known to be conservative) loaded data about himself that positioned him as a centrist candidate, then when his core constituency of conservative voters use Voting Buddy, Voting Buddy's objective matching tool would likely match these voters with Ron DeSantis or one of one of Donald Trump's other conservative opponents instead of Donald Trump. Similarly, if Donald Trump came up as a top choice for a centrist voter, then the voter would likely dismiss the result as being inaccurate and simply move on to the next candidate on the list. Therefore, there is no incentive for a politician/candidate to present inaccurate information.

    Considering a similar example where data validation is necessary is when a strongly conservative or a strongly liberal/progressive politician/candidate has won the primary, and the candidate tries to reposition himself/herself as a moderate or centrist general election candidate. Of course, Voting Buddy will allow politicians/candidates to change their positions at any time, but Voting Buddy will keep a record of the politicians/candidates positions over time. Voters may be inclined to factor the politician's/candidate's varying positions over time into their decisions regarding who they choose to support.

- Because voters will be able to interactively communicate with the politicians/candidates, the voters will be able to play a role in the verification of the data of politicians/candidates in their voting districts via a form of crowd sourcing.

- We also plan for Voting Buddy leverage artificial intelligence (AI) web crawlers on the internet (outside of the Voting Buddy platform). Because such a wealth of information exists online addressing politician/candidate ideological positions and platforms, strategically using AI via web crawlers can enable Voting Buddy to build automated characterization for the politicians/candidates – and if an automated characterization differs wildly from a candidate's self-characterization, then Voting Buddy could flag the matter (either internally for further scrutiny, or possibly externally to the voters).

Voting Buddy's process depends on politicians/candidates choosing to enter their own data into the Voting Buddy system – Challenge #3. Historically, this has posed a challenge to sites like Voting Buddy in that politicians/candidates have not been sufficiently motivated to participate. Voting Buddy has (and will continue to have) much better participation than similar sites.

- First, Voting Buddy already has the data for all 535 incumbent Senators and Representatives preloaded and verified through Voting Buddy's fall 2022 work. This has put Voting Buddy in a strategically advantageous position.

  - Even if these incumbents decided that they did not want to participate, Voting Buddy could still include them using its "Voting Buddy Estimates" (VBEs) in the same way that it did during the fall election cycle. However, although none of the incumbent politicians that Voting Buddy has contacted in preparation for the 2024 campaign have mentioned any disagreements with Voting Buddy's estimates, 25 Senate and Representative offices have shown interest in verifying their data. (Essentially, they are choosing to speak for themselves through Voting Buddy as opposed to having Voting Buddy speak for them.) Because of Voting Buddy's fall 2022 efforts, the option for incumbent politicians to not participate does not exist – either they can participate based on their own data entries or they can participate based on Voting Buddy's data entries.

  - Given the favorable responses that Voting Buddy is receiving from the incumbents, Voting Buddy expects that the challenger candidates will also want to be included in the Voting Buddy database. Challenger candidates will want to have the same amount of public visibility and comparison opportunity as the incumbent politicians.

  - Similarly, state and local candidates will want to receive the free publicity that Voting Buddy offers. When the expanded version of Voting Buddy is released, if a voter enters a zip code, then Voting Buddy can essentially print a sample ballot with all of the national, state, and local matches for that voter. Therefore, the voter will have a list of the major (well known) politicians/candidates that are matches and all of the down ballot matches of individuals that may have been unknown to the voter.

- Although there are over 700 individuals that have registered with the FEC to run for President of the United States, only approximately 50 of these individuals have begun

raising money. Because the 50 who have begun raising money is a manageable number, Voting Buddy plans to score them in the way that it did the 1,300 politicians/candidates in the fall of 2022. We believe that we can "prime the pump" with these 50, and that these 50 will serve as a critical mass that will motivate others within the 700 candidates to self-register within Voting Buddy. We also believe that the 50 individuals that we estimate will ultimately self-registered (based on the House and Senate trends that we have observed).

- We are in the process of indexing all politicians in the Voting Buddy database, and we will continue to index politicians at the national, state, and local levels that self-register. Therefore, in a matter of months, when any politician is searched using Google, Bing, etc., the Voting Buddy search results will be a top search result (similar to the way that Wikipedia has top search results because of the way its data is indexed). This high visibility will motivate candidate participation in Voting Buddy.

- Finally, as users begin to use Voting Buddy more, Voting Buddy will be able to provide registered politicians/candidates with detailed, aggregated, anonymized constituent data insights for users in their voting districts. One notional example of these kinds of insights is, "In your voting district, highly educated, African American males between the ages of 45 and 55 years old tend to be more socially liberal and more fiscally conservative." We believe that politicians/candidates will be motivated to self-register so that they will be able to access these insights.

Voting Buddy's role as an interactive communications platform will enable it to fulfill a role that is as objective as its previous role involving data acquisition and data validation. However, Voting Buddy's new role is much more scalable and can be scaled in time for the January 2024 primary elections.

Appendix II: Big Data and Voting Buddy

Voting can be a complex process with a lot of information to digest. In this fast-paced era, individuals face a significant challenge in comprehensively understanding the complex world of politics. Traditional methods of researching politicians, reading their proposed policies, and critically analyzing their viewpoints have proven time-consuming and overwhelming.

Voting Buddy disrupts this paradigm and represents a powerful revolution in the world of democracy. By leveraging the potential of Big Data and advanced objective algorithms, this groundbreaking app brings a new level of accessibility, personalization, and objectivity to political information, empowering both citizens and politicians. Users only need five minutes to answer five simple questions and gain a profound understanding of their political alignment.

Beyond its impact on citizens, Voting Buddy also revolutionizes the way politicians engage with their constituents. By analyzing and interpreting vast volumes of data, politicians have a deeper understanding of their voter base. This valuable knowledge enables them to identify key demographics, tailor their messaging, and engage with voters on a more personal level. This objective analysis empowers politicians to better represent and serve their constituents' needs.

Furthermore, Voting Buddy transcends the limitations of the traditional left-right political spectrum. Instead, it provides users with a deeper, more objective, and comprehensive overview of politicians' positions.

The revolutionary potential of Voting Buddy also lies in its ability to bridge the gap between citizens and politicians, fostering a more transparent and responsive political ecosystem. By enabling personalized interactions, the app encourages active participation and informed decision-making. It revolutionizes the way citizens and politicians engage with the democratic process.

In conclusion, Voting Buddy's revolutionary approach, driven by Big Data and advanced algorithms, has the potential to reshape the democratic landscape. Its objective and user-friendly design empowers citizens to make informed decisions while enabling politicians to better understand and connect with their constituents. This app represents a significant step towards a more transparent, inclusive, and participatory democracy.

Appendix III: Navigating Dual Markets – Customized Marketing Strategies for Voters and Politicians in Voting Buddy

Voting Buddy is an online platform that connects voters with like-minded politicians. The platform is user-friendly, convenient, and accessible, which are priorities for both voters and politicians. Even though these two groups are related and have overlapping priorities, the groups are different in terms of their overall goals and the ways that Voting Buddy can help them achieve their goals. Although the platform is a unifier in terms of connecting voters with incumbent and candidate politicians, the marketing strategy needed to reach and engage voters is distinctly different from the marketing strategy needed to reach and engage the politicians.

The primary goals of voters using Voting Buddy are to a) identify where they stand regarding political issues, and b) compare themselves to politicians to identify like-minded candidates. Prior to the introduction of Voting Buddy, many voters simply with these goals being unrealized because there was no mechanism available to enable voters to achieve these goals. In contrast, both of these are achieved through the users' completion of Voting Buddy's political quiz. Voting Buddy's five question quiz, which takes less than five minutes to complete, is quick and fun for voters. Because Voting Buddy has a demonstrated capability to meet both of the voters' goals, and the goals are achieved through a process that is quick, easy, and fun, almost no marketing was needed by Voting Buddy. Voters organically marketed Voting Buddy to other voters. As a result of Voting Buddy's limited marketing strategy, Voting Buddy received 20,000 page views in a matter of weeks.

The primary goal of politicians using Voting Buddy is to reach voters. Unlike voters, who generally do not have a strategy outside of Voting Buddy to achieve their goals, politicians have strategies in place to meet their goals. Therefore, active marketing was needed by Voting Buddy to attract politicians from the strategies that they had traditionally been pursuing and to in them over to using Voting Buddy as a strategy. Voting Buddy's active marketing to the politicians included initiating personalized, direct contact electronically, via telephone, and through face-to-face meetings. In many cases, multiple contacts through various mechanisms (including through the political staffers supporting the politicians) were required in order for the politicians to be willing to incorporate Voting Buddy into their strategies. In the weeks leading up to the 2022 election, the Voting Buddy team attracted the support of approximately ten politicians. After the election, the Voting Buddy team refined the approach and made it scalable. Now, even though politicians are in the middle of a non-election year, Voting Buddy has the support of approximately thirty House and Senate incumbent offices.

As a result of Voting Buddy's varied approaches in reaching the voters and politicians, both groups are growing in their willingness to allow Voting Buddy to meet their distinct, but related, goals.

Appendix IV: The Denver Mobile Voting Pilot – A Report[30]

Note: This article was authored by Mobile Voting, the organization that currently administers voting via mobile devices for select populations of U.S. citizens, including deployed military personnel overseas. Mobile Voting and Bradley Tusk, the Philanthropist behind Mobile Voting, are Voting Buddy partners. Mobile Voting and Voting Buddy are currently discussing ways to deepen the partnership including enabling mobile voters to use Voting Buddy to learn about the political candidates before voting (since the mobile voters are outside the political advertisement media markets).

Summary

This report describes the following: the post-election audit process of the Denver Municipal election mobile voting pilots conducted by the National Cybersecurity Center. An overview of how informed military voters, their families and civilians residing overseas received, marked and returned their ballots from their iOS and Android smartphones from 36 countries.

Note: 100% of survey respondents said that of all the methods of voting, they preferred voting on their smartphone.

The Problem: How Can Denver Provide a Secure and Convenient Way to Vote for Military and Overseas Citizens?

In preparing for its 2019 municipal election, the City and County of Denver needed to identify a solution to the unique obstacles faced by overseas citizens and active-duty military personnel and their families. Those obstacles range from poor mail delivery to lack of access to regular mail. Because of these unique challenges, state and federal laws, including the Uniformed and Overseas Citizen Absentee Voting Act (UOCAVA), grant special voting privileges to these voters, including an electronic method of voting.

Denver had been offering a web-based platform through which qualified voters can access and mark their ballot over several election cycles. Because UOCAVA voters are required to sign an affidavit with their voted ballot, they needed to print, sign, and then scan the affidavit in order to return their ballot electronically. Since most voters in these circumstances are unlikely to have access to a printer and scanner, these requirements presented additional hurdles, impeding their ability to vote.

Assuming voters were able to successfully print, sign, and scan their affidavits, they then needed to securely transmit their voted ballot and signed affidavit back to the Denver Elections office. Because Denver does not have access to the secure file transfer site used by the Colorado Secretary of State for municipal elections, email became the only electronic method of return. UOCAVA voters were forced to email PDF attachments containing their voted ballot and signed affidavit. This is one of the most insecure return methods available and offered voters and Denver Elections no assurance that the email was not tampered with and that the ballot was received as marked.

In short, before 2019 Denver UOCAVA voters had very limited options when it came to voting – all of which were highly insecure and inconvenient.

The Solution: A Blockchain-Based Mobile Voting Application

Denver determined that a blockchain-based mobile voting application could offer a more secure method of returning cast ballots, compared to email and even the secure file transfer site. The election office sought a solution that could utilize the convenience of a mobile device, while enhancing the security and transparency of the electronic voting experience for UOCAVA voters. Mobile devices increase the convenience of voting electronically by offering a single tool by which voters could meet all of the requirements to vote without the need for printers, scanners, or other equipment. Voters can receive and mark their ballot and sign the required affidavit all on their device. By using a mobile application, Denver could utilize the device's security features, including hardware-based encryption and biometrics, to ensure that only the eligible voter can access and vote his/her ballot. Casting and recording votes over blockchain ensured that mobile votes were immutable and tamper-proof once recorded. The blockchain-based solution also offered a transparent method through which voters could verify their ballot was recorded as intended and independent auditors could assess whether the election outcome was correct.

The Pilot: Partnering with Voatz, Tusk Philanthropies, and the National Cybersecurity Center

The Denver Elections Division partnered with Tusk Philanthropies and the National Cybersecurity Center to conduct a security audit and review of several vendors offering blockchain-based mobile voting applications. After public demonstrations with experts in blockchain, elections, and voting rights, Denver selected the Voatz application for use in both the municipal general and run-off elections.

When the facial recognition portion was finished, voters were then able to access their ballot, mark their selections and proceed to sign the affidavit directly on the phone's touchscreen, effectively eliminating the need for any secondary technology. Voters then use their biometric fingerprint as registered in the phone's internal security to cast the ballot. Once a voter submits the ballot, the voter receives a digital receipt showing his/her ballot selections. If a voter noticed something amiss, he or she could immediately cancel the vote and receive a new ballot through traditional methods.

The Denver Elections office simultaneously received an anonymized copy of the digital receipt as well as an email containing the signed affidavit. The UOCAVA processing team proceeded with signature verification following the same guidelines used for all voters. The cast ballots were housed in a separate Voatz dashboard, only to be accessed in bulk when preparing to tabulate the election results. The dashboard required two designated users to sign-in simultaneously to download and print the ballots directly onto ballot stock for scanning and tabulation with all other ballots cast.

Transparency and Auditability

Following the election, Denver also piloted a third-party audit tool to make the votes cast through the blockchain fully transparent and auditable. This digital bulletin board was made available to any interested party who wanted to participate, including election observers and experts in election administration and blockchain technology. The tool enabled auditors to verify each of the following steps:

- Votes recorded on the blockchain from the voter's device.
- Votes recorded on ballot images extracted from the blockchain.
- Votes recorded in the tabulation system from the cast vote record.

The data was verified against the anonymized voter-verified digital receipt. Eighteen independent auditors participated in the initial audit following the Municipal General Election. All auditors confirmed the accuracy of the cast vote record against the voter-verified digital receipts.

Results and Findings

Overall, the pilots in the Municipal General and Run-Off Elections were successful, and the Denver Elections Division was recognized with the Democracy Award from the National Association of Election Officials. Turnout among UOCAVA voters more than doubled the previous municipal election, suggesting that the more convenient voting method may have encouraged more voters to participate. In surveys of voters who participated in the pilot, they unanimously stated they preferred to vote through the mobile app over any other method of voting in the future. And the third-party audit demonstrated successfully that the votes cast over the blockchain were recorded and tabulated accurately.

In the future, this technology holds the promise of making voting easier not only for UOCAVA voters, but also voters with disabilities. And the transparency of the system holds the promise of offering an end-to-end verifiable election system through which anyone can verify the election outcome is correct – a critical step forward in protecting and preserving our democratic process.

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