Poster: Universally Usable Privacy in Write-In Voting

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1. INTRODUCTION

Today, casting a vote during an election should be an effortless act for all people. All voters should be able to vote for the candidate of their choosing, and cast and review their ballot independently and privately. Most systems utilize speech to interact with visually impaired voters, so privacy is an extremely important consideration in the design of voting systems. Unfortunately, this is not the case at every polling place in the United States.

In order for voting systems to be universally usable, meaning the system is accessible for anyone to vote privately and independently, it must incorporate a universal design. Universal design is an approach to the design of all products and environments to be as usable as possible by as many people as possible regardless of age, ability, or situation [2]. A universal design ensures that all people, regardless of disability, are able to cast their votes without assistance, providing the privacy to which they are entitled.

Throughout the history of voting, voting officials have sought to improve the process of voting by creating ballots, refining their designs, and accurately counting votes. However, as discovered during the 2000 United States Presidential Election, ballot designs were lacking in usability and reliability [11]. As a result of the major problems during this election, the Help America Vote Act (HAVA) was created to replace punch card voting systems, establish the Election Assistance Commission (EAC) to assist in the administration of elections, and to establish election standards [6].

The EAC has since adopted Voluntary Voting System Guidelines (VVSG), expanding access for individuals with disabilities to vote privately and independently [12]. The VVSG provides requirements for voting systems to be tested to ensure functionality, security, and accessibility [9]. Most voting systems today come equipped with an accessible option, using auditory channels as a means of communication. However, these systems are inaccessible for people with motor impairments, or if a disabled voter wishes to write-in a candidate's name. Fortunately, there exists a research prototype (Section 2.4) that fully addresses universal (accessible) usability, including writing-in a candidate's name.

2. VOTING SYSTEMS & USABILITY

There are several different types of voting systems in use today, the majority of which are optical scan paper ballots and direct recording electronic (DRE) systems. Hybrid systems have also been developed, incorporating DRE and optical scan technologies. Unfortunately, over 4% of the counties in the US are still using ancient practices, such as punch cards, lever machines, and hand counted paper ballots (Table 1). This section discusses where the design of these systems fails with regard to universal usability, and presents a research prototype that is universally accessible while still maintaining the privacy of the voter's ballot.

Table 1 Voting Equipment Reported for the 2008 Elections [2]

Type of Voting Equipment	Counties	
	Number	Percentage
Punch Cards	11	0.35
Lever Machines	62	1.99
Hand-Counted Paper Ballots	56	1.80
Optically Scanned Paper Ballots	1,836	55.90
Electronic (DRE) Systems	1,068	34.26
Mixed	84	2.69
TOTAL	3,117	100.00

2.1 Optical Scan

The method of optical scan is similar to the method used in standardized testing. Voters fill in a bubble or circle next to the names of their choices. These paper ballots are then read and tabulated using an optical scanner [11]. One of the obvious issues with this method is that people who are unable to see or fill in the bubbles would not be able to use this system without assistance from someone else, therefore violating their privacy. An improvement over the optical scan method is the DRE system.

2.2 DRE

DREs are electrical vote recording machines in which a touchscreen typically serves as the interface for voting. The ballot is simply displayed on the screen, and the voter makes selections by touching the party for which they intend to vote. Where this method has increased universal usability over optical scan is that the machine has the functionality to read the ballot to the voter through a headset. A visually impaired voter can hear the ballot and make selections by pressing the appropriate key on a keypad attached to the machine [7]. However, this method is ineffective for those who have severe motor impairments, and are unable to press the keys. Such voters would need assistance voting, hence violating their privacy.

2.3 AutoMARK

ES&S AutoMARK is a hybrid system of optical scan and DRE that addresses usability. Using AutoMARK, voters use the touchscreen to vote. If the voter has a visual impairment, they may vote using the headset and keypad. Once the voter is finished, a completed ballot is printed and scanned in at a separate terminal to be counted. The voter assist terminal allows those voters who are visually impaired, or have a disability that would make it difficult or impossible to mark a ballot as required by optical scan [1]. However, once again, voters with motor impairments may have difficulties utilizing the keypad functionality of the interface. ES&S also states that AutoMARK now has the functionality to allow votes for write-in candidates [8]. However, this method uses an onscreen keyboard, which is inaccessible for those who are visually and/or motor impaired.

2.4 Prime III

Prime III is an ongoing research prototype of an electronic voting system [10]. With Prime III, voters can vote, review, and cast their ballots privately and independently through speech and/or touch. One may think that utilizing speech to communicate with the system would violate the voter's privacy. Prime III has a unique interface in which voters can speak their selections without any bystanders deciphering their ballot decisions.

As with other electronic voting systems, Prime III has the ability to read the ballot to the voter. What differs is how the voter responds. Each candidate is presented to the voter in random order through a microphone headset. The voter selects which candidate they want to vote for by simply speaking "vote" into the microphone. If the voter does not wish to make a selection, s/he remains quiet, and the system moves on to the next candidate. The system recognizes any sounds the voter makes, enabling voters who utilize sip and puff machines to make selections. Voters can navigate the ballot, make corrections, and cast their votes in the same manner. Voters can vote independently, while maintaining the privacy of their ballot. This speech interaction makes Prime III the most universally usable method for voting today. In addition to the interaction with the pre-determined ballot, voters have the additional option to privately write-in a candidate's name through speech [4].

2.4.1 Write-In Voting

To write-in a candidate's name accessibly, the voting system must utilize speech interaction. In order to do so, the voter must spell the name of the candidate for which they intend to vote. Hence to spell a name through speech interaction to remain private, the interaction method of Prime III must be used. However, prompting a voter with each letter of the alphabet until the proper letter is prompted, in a linear manner, for each letter of the intended candidate's name would be extremely time consuming.

The first function of the solution to this time consuming process is to group letters into 5 clusters (i.e. A,B,C,D,E) to first be presented to the voter [4]. Once a cluster is selected, the letters of that cluster can then be presented to the voter. This process, still, can be a bit exhaustive of the voter's time. The second function of this solution is to incorporate name prediction in the process [4]. When letters are selected, a common name can be suggested to the voter based on the letters spelled. The voter can then vote for the name suggested, or continue spelling a different name. This process for writing-in a candidate's name rounds off Prime III as the most universally usable voting system today.

3. CONCLUSION

Several voting systems were highlighted, including optical scan, direct recording electronic, AutoMARK, and Prime III systems. Each system respectively increased in usability, further incorporating a universal design in the design process. Prime III proves to be the most universally usable system, on which voters can vote independently while maintaining the privacy of their votes.

4. ACKNOWLEDGMENTS

This material is based in part upon work supported by the National Science Foundation under Grant Numbers CNS-0540492 and 0837675. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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