HUMAN FACTORS and ERGONOMICS SOCIETY

Policy Statement on Voting Systems

October 2023

Summary

Election operations and their integrity are critical to a sustained democracy, an issue that has received increased public scrutiny in recent years. This is an area where Human Factors science plays a critical role. If ballot marking and tabulation do not accurately reflect the will of the voters, it threatens election integrity just as would other kinds of fraud or malfeasance. Human Factors is the scientific approach of studying how humans interact with complex systems with the objective of improving human performance. There are multiple areas in voting where human factors concerns are applicable: general usability of voting systems, accessibility, overseas voting, ballot counting, ranked choice voting, and ballot verification. Several policy recommendations are proposed to address these challenges and help ensure the integrity of election processes.

Background – Reducing human error in voting

Concerns about election integrity have existed for as long as there have been elections, but the recent past has seen a measurable uptick in interest on the issue (Mongrain, 2023; Vail et al., 2023). While election integrity concerns include ballot security and access to the polls, it also includes the accurate transfer of voters' intent onto the ballot. That is, if voters find ballots misleading such that it is prone to error, the ballots will not represent their intent, and thus the election results may not match the will of the voters. This kind of concern was sparked by the 2000 Presidential election and the now-infamous "butterfly ballot" used in Florida (Harris, 2004; Agresti & Presnell, 2002), for example.

As a direct response to the 2000 Presidential election, the federal government passed the Help America Vote Act (HAVA) in 2002 and established the United States Election Assistance Commission (US EAC) to help fund and execute the modernization of voting equipment across the country. Despite these efforts, and for a variety of reasons, concerns about election integrity are prominent. Some of these concerns are related to several human factors issues that affect elections today. This is particularly challenging from a policy standpoint since Article 1, Section 4 of the US Constitution states that the federal government has limited power to regulate the conduct of elections. Elections are instead regulated at the state level, and most states delegate the administration of elections to the county or other jurisdictional levels. There are over 3,000 counties in the US, which means that there is a variety of equipment, ballot designs, and approaches used, with varying effectiveness for meeting voter needs and intent.

Often, human errors are caused by design flaws that do not take human capabilities and limitations into account. Poor design encourages errors; good design can prevent them. Based on scientifically derived data on how people perform and methods for improving their performance through improved system design, human factors science has been used for decades in many domains to both reduce the frequency of human error and mitigate the impact of errors that might occur.

Human error in voting (defined as votes that are not consistent with voter intent) can be effectively prevented through the proper design of ballots, voting machines, and voting processes that are consistent with human capabilities and expectations. For example, when automated teller machines (ATMs) were first deployed, people routinely left their bank cards behind due to their poor design. These errors are now rare as modern ATMs are better designed to require only a card swipe or require people to remove their card before dispensing cash. Simple design decisions such as these can reduce, or eliminate, the propensity for human error.

Critical Areas

Following are six major areas where Human Factors science can help to ensure the ability of voting systems to accurately reflect voter intent.

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Voting System Usability

To ensure that voting systems accurately reflect voter intent, they must meet the highest standards of usability. ISO 9241-11 defines three metrics for usability: effectiveness, efficiency, and satisfaction. It is crucial that all three of these criteria be met for all voting systems. (1) Effectiveness: in order for elections to be trustworthy, it is vital that voters' intent be accurately captured; (2) Efficiency: in order for polling places to run smoothly, voters must be able to complete the voting process in a reasonable time; and (3) Satisfaction: voters must not find the voting process too onerous and they must find the results trustworthy. It is important to ensure that voting systems achieve high levels of usability across all three metrics. Contributing to usability are ballot design issues such as ballot length, format, graphic design, and the complexity of ballot questions can all affect voter perceptions and errors. In addition to ballot design, registration materials, poll worker training, and materials that support mail-in voting all affect voting accuracy. Support for voters with low literacy and non-English speakers adds to this complexity. Unfortunately, many current best practices for improving usability are not actively applied in elections and few election administrators are human factors experts. Further research on voting system usability has identified a number of issues and the need for improved usability of voting systems (Byrne, 2017; Everett et al., 2006; Acemyan & Kortum, 2015), vote-by-mail ballots (Selker & Blanchard, 2020; Norden et al., 2006), and election and voter information on government websites (King & Youngblood, 2016; Harrell et al., 2013).

Ballot Verification

When voters complete filling out their ballot, they are often inaccurate in checking it for mistakes (Acemyan, Kortum and Payne, 2013; Bernhard et al., 2020; Kortum et al., 2020). With some voting systems, this is particularly important. Many jurisdictions now use a voting machine called a ballot marking device (BMD), which is essentially a voting computer attached to a printer that prints out voters' selections. The paper ballot is the ballot of record; the computer does not store the vote. On the surface, this seems like an ideal solution—all the potential usability and accessibility benefits of a digital interface, but a paper record for security and auditing. However, this also makes it incumbent on voters to check that the paper record matches their intent. As most voters do not check their ballots carefully, if at all, (Acemyan, Kortum and Payne, 2013; Bernhard et al., 2020; Kortum et al., 2020), there is a need for additional research to determine methods that support easy ballot verification.

Accessibility

Voting rights are not reserved only for the abled. Both the Americans with Disabilities Act (ADA) and the Help America Vote Act (HAVA) legally require that voting systems accommodate voters with disabilities. For example, paper ballots are particularly challenging for voters with visual or motor impairments. Polling places are required to have alternatives to paper ballots available, but these alternatives are not always well-implemented or well-understood by poll workers. However, few election administrators have the expertise relevant to ensuring universal access to the vote and have few resources to devote to this issue. There is a clear need for continued advancement in the accessibility of voting, holistically, to ensure equity for all voters (Bernardo & Macht, 2022; Quesenbery, 2006).

Overseas Voting

Living outside the US does not suspend a US citizen's right to vote. Most overseas voters are members of the US armed forces, and their situation raises special concerns regarding ballot secrecy and security. Solving those issues in a way that also meets usability requirements is a challenge. Active-duty military members have both lower registration and turnout rates than domestic civilian voters (Von Spakovsky & Eversole, 2009; Eversole, n.d.). Of those active-duty military members who cast a ballot, few are counted (Eversole, n.d.), largely because of delays in ballot arrival. It is imperative that those charged with defending our nation are successfully included in the voting process. This particularly complex problem requires the coordination of local voting jurisdictions with international sites.

Ballot Counting

Increasingly in the last few years, there have been calls for hand-counting of ballots, ostensibly in the name of security and to address concerns regarding accuracy. However, hand-counting large numbers of ballots is a task for which humans are particularly poorly suited; people have been found to be both inaccurate and slow (Ansolabehere et al., 2018; Forrest, 2022; Goggin et al., 2012; Goggin et al., 2008). The degree to which hand-tally errors occur is not broadly known; however, studies and audit reviews indicate that there are consistent discrepancies between initial tabulation results and recounted results when ballots are tallied by hand (Ansolabehere & Reeves, 2004; Atkeson et al., 2009), with differences up to 20% (Ansolabehere & Reeves, 2004, p. 4). For example, optically

scanned ballots provide significantly less tabulation error (Ansolabehere et al., 2018), .5% when compared to a hand recount, versus ballots that were initially counted by hand which provided a 2.5% error rate (Ansolabehere & Reeves, 2004, p. 7). Counting ballots is a task that machines do both more accurately and more quickly than people. Simultaneous demands for rapid election results reporting also contradict the purported benefits of having ballots hand-counted.

Ranked Choice Voting

Ranked Choice Voting (RCV) is a method of voting, sometimes called instant-runoff voting, where voters rank-order their choices in each contest, rather than voting for only a single candidate. This method has been gaining popularity of late and is now deployed statewide in Alaska and Maine, as well as for primaries and local contests in many other jurisdictions. While there are a number of benefits of such an approach, there are potential downsides as well. Not only does it increase voter workload, but RCV ballots can effectively be disqualified if a voter does not rank enough candidates. Furthermore, this results in substantially more complex ballots. There is as yet no consensus on how such ballots should be designed, and little is known about the usability properties of the various methods for structuring such ballots. In addition, little is known about the various decision-making and ranking algorithms used to process these ballots within and across jurisdictions, causing potential challenges and opportunities for malfeasance.

Policy Recommendations

In light of these issues, HFES provides the following recommendations:

Recommendation 1 – Improve Voting System Usability Standards

In keeping with the designation of election systems as critical infrastructure, voting systems should be required to meet established usability standards (e.g., ISO 9241-210) and follow industry standards for designing and testing user interfaces (ANSI/HFES 400) by reporting the voting system's Human Readiness Level (HRL). The HRL assesses the degree to which a technology or system has considered human usability and performance within the technology development and testing process. In particular, all voting systems should be required to demonstrate achieving at least Level 8 of the HRL standard prior to being put into use. HFES recommends that all states adopt the HRL standard as a certification requirement.

Recommendation 2 – Support the Adoption of the VVSG

The US EAC Voluntary Voting System Guidelines (VVSG) Version 2.0 provides a set of specifications and requirements against which voting systems can be evaluated. Functionality, accessibility, and security capabilities are among the factors address in the standard. HFES recommends that all states adopt the VVSG 2.0 as a certification requirement. Local election jurisdictions should be encouraged and financially supported in the replacement of outdated voting systems with equipment that meets this standard.

Recommendation 3 – Support Voting System Usability Research

More research on different voting machines and processes (as instituted nationwide) is needed to develop improved guidance for ensuring voting integrity. This need should be addressed by creating a voting-specific research area at the National Science Foundation (NSF) with the collaboration and cooperation of the Accountable Institutions and Behavior (AIB) program and/or the NSF Convergence Accelerator Program (Alvarez et al., 2021), or by providing the US EAC with a grant program and specific funds directly supporting work with the National Institute of Standards of Technology (NIST) aimed at addressing shortfalls in human factors research on voting systems. This research should also address challenges associated with ballot verification, supporting audits, improving accessibility and overseas voting, and the development of improved ballot formats for ranked choice voting and new voting approaches and devices.

Recommendation 4 – Develop Election Official Training Resources

The US EAC should be funded and charged with supporting the development of highly usable and understandable resources for local election officials, including best practices to ensure that usability research results and recommendations are communicated effectively to those who must implement them. Field guides developed by the Center for Civic Design are a good example. This work should include research to ensure effective training programs and approaches.

Recommendation 5 - Hand Counting

Because human accuracy in hand-counting is poor, HFES recommends against the reliance on hand-counting of ballots for anything other than smaller election jurisdiction elections, risk-limiting audits (RLAs), or legally required recounts. Concerns regarding security are legitimate and serious, but they are best addressed by the use of rigorous risk-limiting audits. Risk-limiting audits (Lindeman & Stark, 2012; Morrell, 2019) are the gold standard and ensure the integrity of machine-counting. However, as of 2022, only three states (i.e., Colorado, Rhode Island, and Virginia) have RLAs in statute, with four states as optional and eight with pilot programs in various stages of maturity (NCSL, 2022). These audits better align with human capabilities than counting large numbers of ballots by hand and should be deployed universally alongside machine-counting to verify accuracy. Therefore, HFES also recommends that states adopt RLA programs, especially if jurisdictions in that state require that ballots be tabulated by hand.

Recommendation 6 – Create a National Center for Voting System Usability Evaluation

A national Center for Voting System Usability Evaluation should be created that would establish usability standards for voting systems and would provide the capability for voluntary usability certification of voting systems.

About the Human Factors and Ergonomics Society (HFES)

With more than 3,000 members, HFES is the world's largest nonprofit association for human factors and ergonomics professionals. HFES members include psychologists, engineers, and other professionals who have a common interest in working to develop technology, tools, environments, and systems for safe and effective human use, including in challenging conditions. Members of HFES play a leading role in the development of guidelines and standards and are active in national and international standards organizations, such as ASTM, ANSI, NEMA, and ISO.

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