

**American Association for the Advancement of Science
Scientific Freedom, Responsibility & Law Program**

**Position Statement for the AAAS
Workshop on Developing a Research Agenda for Electronic Voting Technologies
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This position statement makes two points:

- Usability and user-centered design are critical to electronic voting systems.
- The ballot metaphor for electronic voting is impoverished and should be broadened.

Usability and User-Centered Design

Usability is critical to all electronic systems that involve interactions with people. Human-Computer Interaction (HCI), the science of understanding how people are going to use a system and the practice of designing in correspondence with that understanding, is especially critical to voting technologies. If voters cannot comprehend what is on a ballot, if they cannot easily remember or recognize their choices, if they have difficulty carrying out the actions required to cast a vote, if they make mistakes, and if they lack trust and confidence in the voting apparatus, then there is little point in insuring the security, privacy, and accountability of their likely erroneous choices.

The user population for voting technology is extremely diverse, consisting of almost all U.S. citizens over the age of 18. Voters include people with various perceptual, motor, and cognitive abilities and impairments; speakers of multiple languages; individuals at all educational and literacy levels and with varying familiarity and comfort with technology in general, and people with a multitude of other significant physical, cultural, and experiential differences. Two complicating factors that add to the usability problem for voting are first, that ballot contents and voting technologies differ among districts and between elections, and second, that ballots are designed by election officials without formal usability training.

Usability standards for many issues such as legibility and comprehensibility currently exist to help in the design of ballots. Unfortunately, as the Florida ballots in 2000 showed, it is often difficult to achieve good usability even with standards. Electronic voting systems introduce a host of new issues for voters, such as navigability, error checking, and trust in vote recording. It is critical that guidelines for usability and usability testing be developed for electronic systems. Electronic voting technologies allow for the interface code to be separated completely from other code designed to record, save, and transmit voting information. It is accepted, good software development practice to make the interface independent of other aspects of computer programs. The advantage is that the interface can be tested and modified independently from all other parts of the system, and then "plugged in" at a late stage of production. This allows for iterative

prototyping of interface elements and it allows for changes in interface technology to be integrated easily with legacy systems. This practice also allows HCI experts to develop interfaces, including multiple interfaces to the same underlying systems, for purposes of user testing. Interface independence, rapid interface prototyping, and iterative user-centered design and evaluation should be a mandatory part of the development of electronic ballots in each election cycle.

User-centered design is the practice of involving users and users' perspectives in the development process. Guidelines for electronic ballots should include the collection of behavioral data from multiple user groups, and standards should include behavioral targets for specific groups. A system which fails to meet behavioral standards, or which has not been user tested, should be treated the same way as a system that fails to meet security standards or has not undergone security testing, i.e. it should not be fielded. This requirement would have to be met anew for each ballot with significant differences. To facilitate this process, ballot construction toolkits should be developed that can be used by local elections officials to produce and test various electronic ballot designs.

Beyond the Ballot Metaphor

Current electronic ballots resemble the paper ballot that was originally developed in the early nineteenth century. That is, they have checkboxes next to textual names and issues. A significant challenge for electronic ballots will be to go beyond the paper ballot metaphor.

Within the context of voting, electronic ballots could (among other things):

Offer online help. A simple example might be a popup window that reminds a voter how to uncheck a box, but a more problematic example would be an animated agent that helps explain the text of a ballot issue.

Interact with voters' electronic devices. A simple example might be the ability to "beam" a marked-up sample ballot from a PDA into a voting machine, but a more problematic example would be the ability to send an issue from the voting booth to someone else and receive advice (e.g. by picture cell phone), or to allow a third-party template to populate a ballot.

Offer alternative interfaces according to user preference. A simple example is the ability to change languages or modalities (e.g. text to voice), but more problematic examples would be to allow summarized or expanded content, or dynamic reordering of ballot items.

Many other electronic ballot features could be added to this list. This short list illustrates the point that there are many issues to be explored once designers step outside of the paper ballot metaphor.

More broadly conceived, electronic balloting systems should ultimately exist as part of a larger "voter support system" that helps people to deliberate and make decisions. Such a system would provide voters with information from multiple sources, allow voters to connect with each other, support annotation and information sharing, and otherwise create a true "digital democracy." A seamless integration of electronic tools for voter-directed information gathering, deliberation, debate, decision, and voting should be the grand vision, ultimately supplanting the idea of simply making electronic replicas of paper ballots.

The purpose of considering these unusual ideas now is that new voters (18-20 year olds) and voters of the near future (14-17 year olds) are already using many such tools. They are

comfortable with digital communities and ubiquitous electronic communication. They already participate in political dialogue in many existing electronic forums and portals. This user group should be an important reference community for developers. They can provide more appropriate design metaphors for the future.

Research Agenda

This position statement raises several research questions. Here is a non-exhaustive list:

- What new usability issues are introduced in electronic voting systems?
- How do different groups of people (e.g. different ages, education levels, technology experiences, income levels) interact differentially with electronic voting systems?
- What human performance standards should be developed for electronic voting systems?
- How can usability non-experts (election officials) best evaluate new systems?
- How can voters participate in the design of electronic voting systems?
- What types of interface prototyping and ballot construction software tools might be developed for designers of electronic ballots (usually, election officials)?
- What is voters' tolerance for rapid prototyping, e.g. new interface features in each election cycle?
- What new features enabled by electronic voting systems are envisioned and acceptable to voters, and how might this differ among various voter groups?
- How do new features enabled by electronic voting systems fit into the legalities and ethics of voting (e.g. privacy, freedom from coercion, prohibition of political advocacy in the voting area), and how might this differ for various voter groups?
- Will electronic ballots raise the participation of young people, who currently vote in low numbers but who use electronic technologies extensively?