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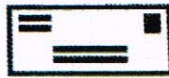




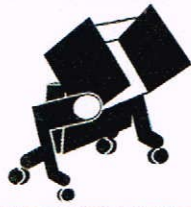



user experience

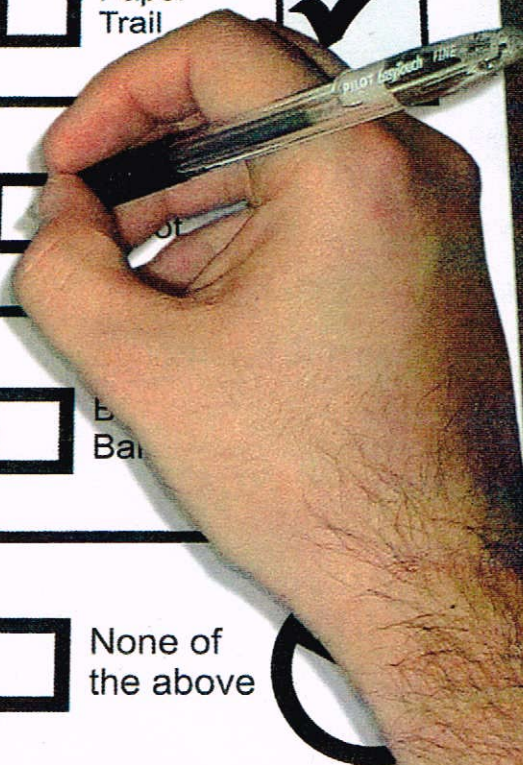
THE MAGAZINE OF THE USABILITY PROFESSIONALS' ASSOCIATION
Spring 2005

Usable Voting: What We Found, What's Next

- A Day Watching Computerized Voting
- Observing the U.S. Presidential Election
- The Politics of Usability

Official Ballot
Vote for only one
(or maybe two)

<input type="checkbox"/> Privacy 	<input type="checkbox"/> Mail Ballot 
<input type="checkbox"/> Wheelchair Access 	<input type="checkbox"/> Paper Trail 
<input type="checkbox"/> Online Voting 	<input type="checkbox"/> 
<input type="checkbox"/> Computer Voting 	<input type="checkbox"/> Ballot 
<input type="checkbox"/> Paper 	<input type="checkbox"/> None of the above 



What's in Store
for Your Car's
Dashboard?

A Day of Poll WATCHING

RENO AND SPARKS, NEVADA

BY TED SELKER

In September 7, 2004, I traveled to Reno and Sparks, Nevada with members of the California Secretary of State poll-watching effort. We observed a rollout of new Sequoia direct-record electronic voting systems with verifiable paper-trail printers. I watched everything I could and conducted interviews with poll workers, election officials, and exiting voters at eleven different polling places covering almost forty precincts.

What I saw both encouraged and horrified me. The paper "receipts" were less confusing than I had feared. Poll workers and voters alike showed an eagerness to "get it right," even when initially frustrated. However, things went bad when workers had inadequate time to set up or test equipment, when procedures were ignored or forgotten, or when no standard policy existed to provide guidance.

The Reno polling places I visited were spacious, well-lit, clean, and wheelchair-accessible. One had an ATM machine, which one voter mistakenly attempted to shove his card into; it gave his card back.

I was surprised at the sheer number of machines—twenty in every location. These were lined up in two long, squashed rows, typ-

ically with fifteen feet between the rows and with voters' backs facing each other. Any voter could watch how his neighbor was voting. Standing in the center of the room one could read everyone's ballots. Set ups I recently observed in Los Angeles and Boston showed greater sensitivity to preserving privacy. There, machines were arranged in a square, each facing outward.

The Reno machines had been set up on Saturday and Sunday and then left locked, but unguarded, in a church until the Tuesday election. (Many other jurisdictions do not allow elections to be held on the day after a holiday.) It would not have been unduly expensive or complicated to place numbered seals that tear when tampered with on polling place doors.

Start-up Problems and Responses

This September 7, 2004, was the Sequoia Voting Systems computerized voting machines' public debut. The introduction included a number of problems due to lack of procedures, lack of instructions, and insecure handling of the ballots; but no evidence of any kind of fraud. A machine at one location had been shut down since the beginning of the election because the touchscreen wouldn't work. Approximately one in every twenty printers jammed. A couple who I met complained that one of them had to have a smart card reprogrammed three times (the other, once) before they could vote. Smart card programming problems were not uncommon. However, troubleshooters from Sequoia and election

headquarters arrived within minutes wherever and whenever they were called.

Audio Testing Didn't Happen

I inquired about the audio capability built into the machines for use by blind voters. A polling place manager explained that no one where she had worked setting up the machines had thought to test it beforehand. The audio systems could not be tested on Election Day without actually voting.

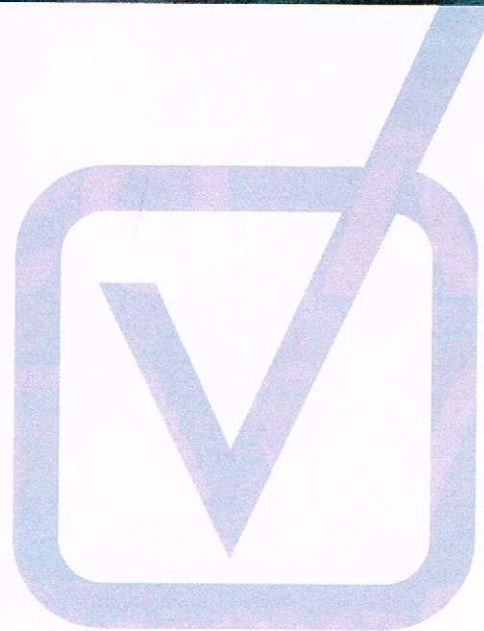
Start-up Procedures Delayed

We arrived at our first stop at 6:59 a.m., one minute before the polls were scheduled to open. Poll workers were still setting up their check-in tables and the electronic touchscreens were black. A distressed worker moaned, "This was terrible. We weren't able to get in

Running on Battery

When I returned to this location at 10:00 a.m., a frazzled poll worker reported, "At 8:30 a.m., all the machines began shutting down here; the outlets were not active." In the morning rush, workers had plugged the voting machines into a dead circuit and accidentally run them on battery power. While I had photographed a red battery warning screen earlier, no one else had been troubled by it, nor had they taken heed of the red bar on the bottom of the touchscreen that indicates when machines are running on battery. An improvement might be to have the words, "Operating on battery: alert poll worker," in the red bar.

Poll workers then used a single fifty foot extension cord to plug ten machines into an outlet, which also had a microwave plugged into it. The high current in the extension cord



A machine at one location had been shut down since the beginning of the election because the touchscreen wouldn't work.



here until 6:45 a.m." The county registrar later explained that gaining access to polling places at 6:00 a.m. on the day after a holiday was often difficult.

By 7:08 a.m., twelve voters stood in line. The precinct president, said, "I assumed they [the machines] would be turned on, but..." She raced to switch them on and record the beginning-of-day zero count on a piece of paper. No one was with her to check her work, so I hope her transcriptions were accurate. Without a colleague to check any transcription error, the poll workers would miss any over-the-weekend "voting." Only one of the eleven locations I visited told me that two people had independently recorded serial numbers and odometers before opening the location. Most polling places had only one person trained to set up and close down the machines. By 7:12 a.m., a restless voter bypassed the start-up procedures that assured the beginning-of-day count and started a machine himself and voted.

made it warm to my touch. I couldn't help pointing out that they might unplug the microwave to avoid overloading the circuit. The poll workers explained that they would not use it.

Wrong Ballot Codes Disenfranchised Some People

Voters at the same location realized that they had been prompted to vote only for senator and not for the six other local races on the ballot. A provisional ballot allows a voter to vote for federal races if they are not on a precinct's registration list. The poll workers had accidentally programmed ballots with the provisional ballot codes (PCT0000: Democrat and PCT0000: Republican), which were taped near the front of the activator box, instead of the specific precinct ballots codes that were taped to the box above the keypad. A frustrated poll worker in one precinct moved the pro-

Left: Card activator with the provisional ballot codes pasted on the front. Center: Card activator with the provisional ballot codes partially torn away. Right: Voters who accidentally voted using provisional ballots.

visional codes away from the buttons. A better way to avoid this error would be to have a second poll worker and the voter review the ballot number in the display before using it to activate the voter's ballot.

County officials had told us that they hoped to discourage provisional ballots, which disenfranchise people who want to vote for local candidates and issues. At the Washoe County Government Campus, we observed people being sent to the municipal registrar's office instead of being helped at the precinct because they could not remember which precinct they lived in. The early voting system there had been turned off by law the previous Friday. Therefore, those sent

to this office had to travel to their correct precinct polling places to vote. An improvement would be to either provide every location with a way to help voters determine their correct precincts, or to allow voting at the registrar's office.

At another location, I watched a poll worker help a voter struggle with provisional ballot paperwork for ten long minutes before he suggested that the voter think about where she lived and had registered previously. The voter then remembered and left to go there. The policy worked as planned in this case because the voter was sent to the precinct where she could vote on all races.

nor a Sequoia engineer whom I consulted had ever seen cause a problem), poll workers there handed out unsharpened pencils and instructed voters to use the eraser end to touch the screens. An elderly man banged the unsharpened end of his pencil four times on one button to register his vote. I was afraid that he was going to break the screen. Allowing voters to use their fingers, as the machines were designed for, would have been easier and safer.

Nevertheless, when I conducted an exit interview with this same man, he was enthusiastic about his voting experience, which he described as "No problem." He added, "Next time will be a breeze."

ier to read" and as "a lot easier than the type where you fill in a circle" (she was referring to an optical-character-recognition system).

One voter happily explained, "I looked at the review screen and noticed that the State Supreme Court race that I care about was not selected, so I went back and fixed it."

There were some complaints. Someone remarked, "I didn't know how to end. It [the machine] kept saying to return and kept going back." Others had some trouble finding the small buttons that said "Touch," "Print," and "Review" at the bottom of the screen. An onscreen display offering these functions in larger type would be an improvement. Even



Rolling up some paper-trail printouts from a jammed printer.



Counting room, which adjoined a public lobby.

No Voting Instructions

Only one location I visited offered all voters printed instructions with graphic illustrations. Another was careful to explain how the machines functioned. In most places, however, voters were left to walk up to the machines and read the instructions themselves. People shouldn't have to figure out how to use voting machines on their own. Nor should they have to forfeit their right to secrecy by seeking assistance while in the act of voting.

Voter's sample ballots were mistakenly missing voting machine instructions. A poll worker told me that she verbally instructed all voters. Among other things, her explanation included, "Put the card in the screen," an action that was not only incorrect but also physically impossible.

"Don't use your fingers," I overheard her tell someone else. "They make our machines complain." Worried that finger grease would damage the computer screens (which neither I

User Satisfaction Was High

I saw many people touching their pencils to the well-designed Help America Vote Act (HAVA) complaint instructions on the right of the touch screens for assistance. Even though most voters had been given no guidance on how to use the electronic voting machines, they thought them an improvement.

One befuddled voter said, "The punch card was great," and wanted a copy of his printout. More typical comments were: "Very much easier than punch cards"; "Very easy"; "Much easier"; and "Quicker, clearer, with less room for error." One voter said, "The electronic voting machine made it seem more official than the punch card." Another stated, "It is obvious what you are voting for. The recap is nice."

An elderly woman with a walker progressed extremely slowly through her ballot. Nevertheless, she described the screen as "eas-

though the machines showed paper receipts, one person grumbled, "How do I know that my vote counted without a paper receipt?"

"Receipt" or "Record"?

The Reno and Sparks voters could not view their onscreen selections while confirming the printouts. Nevertheless, they typically swore that their "receipts" exactly matched their electronic selections. Because people make, on average, 1-3 percent errors using direct electronic register machines, this suggests that some voters did not closely review the printouts. In an election with seven races, one in seven voters can be expected to have a discrepancy between what was printed on the receipt and what he or she intended.

As a result of pre-election publicity, most of the voters expected the receipts and glanced at them. One voter said, "I checked"; another, "I

heard it's new"; and a third, "I wasn't really interested because I had already made my choices."

Many people were not exactly sure what the receipts were for. A number of voters moved their hands over the plastic box trying to figure out where the paper came out. One person remarked, "Receipt for me or what? Not sure what they need to let us see that for." "Where is my receipt?" asked another. "I think the voters should get a copy," someone else affirmed. The term "record," which Sequoia uses, is less confusing.

Access and Privacy

We saw almost no Hispanic voters. I met only one official Spanish interpreter. At three o'clock in the afternoon, he had only received two requests for help.

One polling place in a low-income area was almost completely empty. At another, in a neighborhood filled with trailer homes and barred windows, poll workers zealously hovered over voters in the booths. Any pretense of anonymity or secrecy went out the window.

Integrity of the Vote

Ill-advised poll worker behavior, however well-intentioned, eroded the election's integrity throughout the day. One poll worker explained her technique for handling troublesome smart cards: "If the card doesn't work, you just turn off the machine and put the card in a box not to be used." Someone who wanted to shut down an entire polling place could use that policy and disable all the machines.

At another location, a paper-trail printer stood open on a counter. "They told us to replace the paper if it jammed," a poll worker explained. Her instructions included nothing about how to rethread the paper (the instructions at some polling places did and, at others, didn't) so she struggled to figure it out on her own. To help fix the paper jam, she used a pair of scissors to cut some voter records off.

At all but one location, only the warden had been specifically instructed on how to put paper in the new printers. However, she was never taught that a paper-trail printer should be handled with the same care and security protocol as a ballot box. I could imagine her taping the roll inside the printer ballot box and wondering if it would be found later. A second official should monitor the opening and closing of this paper-trail ballot box on the day of election.

Similarly, when we returned to the County Campus to watch the polling place being shut down, the two women who intended to write down the readings separately forgot to do so. The process was unfamiliar and unpracticed.

When I asked the official responsible for counting results how he intended to back them up, he said that he hadn't quite decided. With further prompting, he confessed that he had not made any particular plans to burn a backup CD in case something happened to the original results.

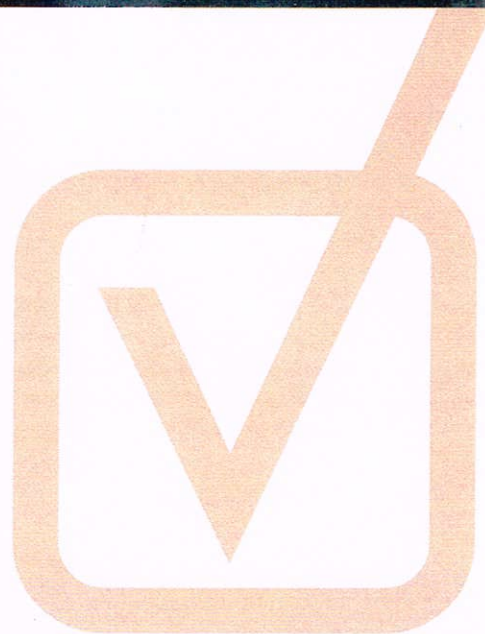
The counting room had five open doors and extraneous objects, and the voting servers had slots for the memory cards and extra USB connectors. The ease with which someone might install a memory-transfer device in the counting machines gave me a start. It was a particularly frightening end to a long day.

Conclusions

Elections do not happen every day. The tasks that poll workers need to do when elections take place are not, therefore, ingrained by force of habit and repetition. Poll workers and voters alike need instruction. A checklist of operating procedure from start to finish must be mapped out and practiced. Poll workers must demonstrate that they can do their jobs before Election Day comes around so that mistakes do not compromise the integrity of actual elections.

Every time that an election worker turns on a voting machine, copies down odometer numbers, opens a printer, programs a smart card, or views tally results on a backend computer, he or she should be accompanied by someone who can corroborate the correctness of these actions. Moreover, every person working at a polling place should be given a laminated checklist of instructions, which might even be worn around the neck. This would eliminate guesswork and the need to remember important but counterintuitive tasks.

As we become more dependent upon technology, we must test this equipment for functionality and usability as well as for security. Breakdowns occur and we must be ready for them. A standard method for handling such situations must be designed so that poll workers can fix problems such as paper jams without compromising the safety



or secrecy of the paper-trail receipts.

The problems I encountered with the Sequoia electronic voting machines and paper-trail audit system resemble those I have seen with every kind of voting system in precincts throughout the country. Since becoming involved in the Caltech/MIT Voting Technology Project in 2001, I have witnessed elections in hundreds of jurisdictions across America. Luckily, most of these problems can be solved if we focus on improving both training and process and the usability of the machines and instructions. It is not too soon to start planning for the next election. **UX**

Postscript: The election officials took notes on my report. The Sequoia voting machines with paper trails used in Reno and Sparks in the November 2, 2004, presidential election appear to have reduced the number of errors in Nevada significantly.

Acknowledgements

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ABOUT THE AUTHORS



Ted Selker is the MIT director of the Caltech/MIT voting technology project that evaluates the impact of technology on the election process and is a member of the IEEE voting standards committee. Ted and Michael Alvarez of Caltech, the co-director, were named as members of the "Scientific American 50" in 2004.

A large part of Ted's voting work is inventing and testing new technologies. Prior to joining the MIT faculty in November 1999, he was an IBM Fellow and directed IBM's User Systems Ergonomics Research lab. He has served as a consulting professor at Stanford University, taught at Hampshire and Brown Universities, and has worked at Xerox PARC and Atari Research.