

AFFIDAVIT OF DOUGLAS W. JONES

NOW COMES Douglas W. Jones, who, first being duly sworn, deposes and says of his own personal knowledge as follows:

1. I am Douglas W. Jones. I am over the age of eighteen, and I am competent to provide this affidavit.
2. I am a citizen and resident of Iowa City, Iowa.
3. I have been asked to submit this affidavit to the Cumberland County, North Carolina, Board of Elections, by Thomas A. Farr, Ogletree Deakins, P.O. Box 31608, Raleigh, NC 27622. My understanding is that Mr. Farr is serving as counsel for Jackie Warner, a Republican candidate for NC House District 45. I understand that Ms. Warner has filed an election protest and that iVotronic touch screen systems were used in Cumberland County for early voting. I am not receiving a fee for this affidavit.
4. For the reasons discussed below, it is my opinion that the summary screens on the ES&S iVotronic and similar direct-recording electronic (DRE) voting systems do not adequately protect voters against vote flipping – a common name for incidents where voters report that they tried to vote for one party or candidate and their vote was recorded for another.

Qualifications

5. I am an Associate Professor at the University of Iowa, Department of Computer Science, where I have taught since 1980. I received my Ph.D. and MS degrees in Computer Science from the University of Illinois at Urbana Champaign, in 1980 and 1976, respectively, and a BS degree in Physics from Carnegie-Mellon University in 1973.
6. My expertise in voting technology includes the following:
7. I served on the Iowa Board of Examiners for Voting Machines and Electronic Voting Systems from 1994 to 2004, and chaired the board for 3 terms. This board examines all voting systems offered for sale in the state of Iowa to determine if they meet the requirements of Iowa law.
8. I was invited to testify before the United States Commission on Civil Rights on evaluating voting technology for their January 11, 2001 hearings in Tallahassee Florida. I was invited to testify before the House Science Committee on problems with voting systems and the applicable standards for their May 22, 2001 hearings. I was invited to testify at an April 17, 2002 hearing of the Federal Election Commission. At that hearing, I recommended changes to the draft voting system standards that were subsequently adopted as the 2002 FEC Voluntary Voting System Standards.
9. I wrote Chapter 1 of *Secure Electronic Voting*, edited by Dimitris Gritzalis and published by Kluwer Academic Publishers in 2002. I wrote “On Optical Mark-Sense Scanning”, a chapter in *Towards Trustworthy Elections*, edited by David Chaum, Ronald Rivest, et al, and published by SpringerLink in 2010.
10. In the summer of 2004, I consulted with Miami-Dade County to assess problems with their ES&S iVotronic touch-screen electronic voting system and to assess their pre-election testing of their touch screen and optical scan voting systems. As part of this consultation, I was able to examine the iVotronic and a substantial amount of accompanying documentation.
11. My paper, *Auditing Elections*, was published in October, 2004 in the Communications of the Association for Computing Machinery.

12. I am one of the ten principal investigators in A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE), a multi-institutional center awarded a 6-year research grant by the National Science Foundation starting in October 2005. The research I report here was funded by this grant, the Iowa portion of which is NSF grant number CNS-052431.
13. In 2005 and 2007, I was invited to Kazakhstan, and in 2006, I was invited to Holland, in all cases by the Office for Democratic Institutions and Human Rights of the Organization for Security and Cooperation in Europe to help assess the electronic voting systems in use in those countries.
14. In December 2005, I was invited by the Arizona Senate Government Accountability and Reform Committee to investigate the Optech 4C absentee vote tabulation system being used in Maricopa County.
15. I offered expert testimony in *Conroy v. Dennis*, a case heard by the District Court of the City and County of Denver Colorado in September, 2006. I testified in the matter of [the] primary election ballot dispute [in] 2008, before the Supreme Judicial Court of Maine in July, 2008, and I testified in *NAACP v. Cortes* before the US District Court for Eastern Pennsylvania in October, 2008. I am currently involved in *Banfield v. Cortes* in the Commonwealth Court of Pennsylvania. All of these cases involve voting technology.
16. In October 2009, I was appointed to the Technical Guidelines Development Committee of the US Election Assistance Commission. This committee advises the commission on the system of voluntary voting system guidelines that govern the construction of voting systems used in the United States.
17. In connection with my research support from the National Science Foundation, and in connection with my seat on the Technical Guidelines Development Committee, I am obligated to state that the opinions expressed here are my own and do not represent any position or policy taken by either of these government agencies.

Vote Flipping

18. Since the widespread introduction of touch-screen voting in the early years of this decade there have been sporadic reports of a phenomenon that has come to be described as *vote flipping*. Voters report that they tried to vote for one candidate, but that the machine showed their vote as being recorded for another. In some cases, the reports suggest that the vote was flipped as they made their selection, while in other cases, the reports suggest that the problem was only noted when the voter reached the end of the voting session and the voting machine showed a summary of all selections made.
19. Because of voters' rights to secret ballots, there is little direct observational evidence of what happens when votes are flipped. In general, all we have are individual uncorroborated voter complaints describing what they recall happening. These complaints do not paint a consistent picture.
20. There were numerous reports of vote flipping in Sarasota Florida during the 2006 general election. Sarasota used ES&S iVotronic voting machines. Some of these complaints from voters were addressed directly to me, by e-mail. In Sarasota, the majority of the complaints had to do with a difficulty casting votes for Christine Jennings, the Democratic candidate in Florida's 13th Congressional district.

21. After the 2006 election in Florida, there was an extensive investigation, including a mock election and a detailed study of the iVotronic undertaken by the Florida Department of State Division of Elections. These studies were strongly criticized by two of my colleagues from the ACCURATE project, David Dill of Stanford University and Dan Wallach of Rice University. Their criticism is publicly available as the report *Stones Unturned: Gaps in the Investigation of Sarasota's Disputed Congressional Election*. This is available on the Internet from:
<http://www.cs.rice.edu/~dwallach/pub/sarasota07.html>
22. The hypotheses advanced to explain vote flipping include problems with touch-screen calibration, parallax (viewing the screen from angles other than head-on), the possibility that the voting system software might deliberately flip votes, and a variety of voter errors, including accidentally touching the screen with a second finger while voting.
23. I have seen a sufficient number of reports of vote flipping that I am not convinced that it is a single problem. Many different problems can lead to voters describing very similar experiences. Some may indeed be caused by touch-screen miscalibration, some by voters accidentally touching the screen with two fingers, and some by other causes.
24. I have seen the affidavit of Sam Laughinghouse dated October 27, 2010 describing his experience voting on a touch-screen voting machine in Craven County, North Carolina. I have heard of several similar cases from North Carolina.
25. In my opinion, these reports are typical “vote flipping” reports, although Laughinghouse's report is unusual in that he was able to bring in witnesses.
26. In my opinion, these reports are consistent with the hypothesis that touch screen miscalibration was the root cause of the problem, at least in the case described by Sam Laughinghouse.

Touch Screen Calibration

27. Touch screen calibration involves the alignment between two distinct devices attached to a computer. One is the display screen, an output device, and the other is a touch screen, a thin transparent input device that sits directly over the output device. These can get out of alignment because of any of several causes, ranging from temperature changes to vibration or impact.
28. Instead of trying to physically move the touch screen relative to the display screen, most touch-screen computer systems include a correction factor in the software that attempts to account for the state of the alignment between the display screen and the touch screen. The computer outputs a series of targets, usually X marks on the screen, and a person is instructed to touch each X with a sharp stylus. The computer uses the difference between the coordinates used to display the X and the coordinates of the corresponding touch with the stylus to compute the correction applied to all subsequent touches.
29. Deliberate and accidental miscalibration are both possible. If the person performing the calibration touches a spot on the screen that is not over the X mark, the computer will apply the wrong correction to subsequent touches, causing their locations to be misreported.
30. Touch screens tend to drift out of calibration with time. This is why ES&S recommends that the iVotronic be recalibrated before each election. I believe that this instruction was written with the expectation that the iVotronic was to be deployed at a regular polling place for just one day. Where the iVotronic is deployed for early voting over a period of weeks, it is natural to require that the machine be recalibrated daily.

31. The iVotronic is designed to be easy for pollworkers to recalibrate, and it is designed so that pollworkers can easily detect that a machine is out of calibration during the election day. The recalibration procedure used with the iVotronics I have worked with requires no passwords or other privileges beyond possession of the supervisor PEB – the same device used to open the polls in the morning and close the polls in the evening.

Research Results

32. In 2004, while I was observing pre-election testing in Miami-Dade County, I did some experiments attempting to investigate vote flipping on the iVotronic systems in use there. I verified that touch-screen miscalibration could lead to one candidate being selected when the voter touched the target on the screen for another candidate. I also verified that a voter could accidentally touch the screen with two fingers. When this happens, the iVotronic reports a touch position halfway between the two fingers. My report on these experiments, *Observations and Recommendations on Pre-election testing in Miami-Dade County* is available on the Internet at:
<http://www.cs.uiowa.edu/~jones/voting/miamitest.pdf>
33. Sarah Everett, a PhD student working under Michael Byrne at Rice University was the first to do a carefully controlled scientific experiment to test the response of voters to a voting machine that deliberately “flipped” votes. This experiment was conducted with NSF funding as part of the ACCURATE project. Everett's 2007 dissertation, *The Usability of Electronic Voting Machines and How Votes Can Be Changed Without Detection* is available on the Internet as
<http://chil.rice.edu/research/pdf/EverettDissertation.pdf>
34. Everett used an experimental electronic voting machine, VoteBox, although it used a mouse, not a touch screen. In Everett's experiment, artificial ballots were used, with fictional candidate names. By having voters use both VoteBox and a second voting method such as paper or punched-card ballots to vote for the same candidates, Everett was able to measure the accuracy with which voters expressed their preferences.
35. In one experiment, Everett exposed one group of voters to a version of VoteBox that had a review screen, and another group to a version that did not. She found that the review screen had no impact on the accuracy with which voters expressed their preferences.
36. In another experiment, Everett exposed voters to a version of VoteBox that displayed different selections on the review screen than it had displayed when the voter first made the selections. In effect, this version of VoteBox deliberately flipped votes. The purpose of this experiment was to ask, do the voters detect the flipped votes.
37. Everett followed up with a satisfaction study. 97 percent of voters felt that having a review screen was helpful, and 87 percent felt that the review screen increased their confidence that their vote was recorded correctly. Only around 1/3 of the subjects who had been exposed to vote flipping noticed the change!
38. Working with two graduate students at the University of Iowa, Andrea Mascher and Paul Cotton, I conducted an experiment that, in part, served as a followup on Sarah Everett's work. Our results are reported in a series of refereed papers presented at various conferences. The most comprehensive of these papers is *Towards Publishable Event Logs that Reveal Touchscreen Faults*. Published in the proceedings of the 2010 Electronic Voting Technology Workshop / Workshop on Trustworthy Elections (EVT/WOTE '10). This is available on the Internet at:
<http://www.usenix.org/events/evtwote10/tech/>

39. As with Everett's experiments, we worked with an experimental voting machine, the Vote-o-graph. Unlike Everett's VoteBox, the Vote-o-graph had a touch screen.
40. Unlike Everett's experiments, we used candidates from the actual ballot from the 2008 general election in Johnson County Iowa, and we required our experimental subjects to be Johnson County voters who had voted in the 2008 general election. As a result, the names of most of the candidates were very familiar to most of the voters.
41. Official elections in Johnson County are conducted using optical mark-sense paper ballots, so many of our subjects had no prior exposure to touch-screen voting machines.
42. We exposed some of our experimental voters to deliberate touch-screen miscalibration and we exposed others to software that deliberately flipped the votes for presidential candidates, so that the review screen showed McCain after voters selected Obama, and visa versa. Unlike Everett's experiments, voters were free to correct the flipped votes, and once corrected, the machine behaved honestly. We also investigated the impact of touch-screen insensitivity.
43. When the Vote-o-graph flipped the votes for Obama and McCain on the summary screen, 2/3 of the voters noticed. This is a far better result than Everett described, but the fact that 1/3 of our subjects did not notice the change is still alarming. I suspect that the high name recognition of the candidates and the prominent position of the presidential race on the summary screen both contributed to the difference between our results and Everett's results.
44. We also noted that touch screen miscalibration had a variety of negative effects. The most important of these is that voters on miscalibrated and insensitive touch screens were somewhat more likely to abstain, skipping over races instead of making selections.
45. We also noted that voters exposed to insensitive touch screens were less likely to go back from the review screen to revisit races they had already voted in. In effect, we believe that when the system is difficult to use, voters are less interested in proofreading their ballots.
46. While our analysis is incomplete, we noted that voter satisfaction and confidence were not strongly impacted by vote flipping. In my opinion, this is because, when voters did notice that their votes had been flipped, they tended to blame themselves for making an error. Only a small percentage of those voters whose votes we flipped actually complained.
47. We collected data on a number of demographic factors. Our participants ranged in age from 18 to over 75 years, with computer and Internet experience ranging from none to over 40 hours per week. Just over 1/5 of our subjects had previously used touch-screen voting machines. We found no useful correlations between demographic factors and voter response to our experiment.
48. In my opinion, the summary screen included at the end of the voting session on touch-screen voting systems is of very limited utility. Between 1/3 and 2/3 of voters will not notice errors on the summary screen, depending on the prominence of the race and candidates involved. In the case of Jackie Warner, because the race for state house is typically listed well below the top of the list on the iVotronic summary screen, I would expect significantly more voters would miss mistakes in her race than in a more prominent race.
49. In my opinion, when voters do notice problems, most of them do not complain. Voters using computerized touch-screen voting machines tend to blame themselves for errors when, in fact, it was the voting machine that was at fault. Only when they have difficulty correcting an error will they complain.

50. In my opinion, anything that makes the voting system difficult to use, including touch screen miscalibration or insensitivity, will decrease the likelihood of voters making selections or correcting errors in selections they have made.

51. In my opinion, voter satisfaction and voter confidence are not useful measurements of the performance of a voting system.

Further, affiant sayeth not.

This 18th day of November, 2010

Douglas W. Jones

SWORN TO AND SUBSCRIBED BEFORE ME

This the ____ day of November, 2010.

Notary Public

My Commission Expires _____