*Ohio State University Moritz College of
Law*

The Ohio State University Moritz College of Law Working Paper
Series

Year 2004

Paper 5

The Paperless Chase: Electronic Voting and
Democratic Values

Daniel P. Tokaji*

*Michael E. Moritz College of Law, The Ohio State University, tokaji.1@osu.edu

This working paper is hosted by The Berkeley Electronic Press (bepress) and may not be commercially reproduced without the permission of the copyright holder.

<http://law.bepress.com/osulwps/art5>

Copyright ©2004 by the author.

The Paperless Chase: Electronic Voting and Democratic Values

Daniel P. Tokaji

Abstract

The 2000 election ignited a fierce controversy over the machinery used for voting. Civil rights advocates have called for the replacement of outdated paper-based voting equipment, like the infamous “hanging chad” punch card. Yet the introduction of paperless technology, especially electronic “touchscreen” machines, has induced widespread concern that software might be rigged to alter election results. This article examines the debate over electronic voting, which raises fundamental questions about the democratic values that should guide the administration of elections. It frames the debate by defining four equality norms embodied in federal voting rights laws and the Constitution. Electronic voting has the potential to advance racial equality, disability access, and multilingual access. At the same time, there are legitimate concerns surrounding the implementation of present-generation technology. The proposed “voter verified paper audit trail” is unlikely to resolve these concerns, though other measures may be taken to promote security and transparency. The article concludes that legislatures and courts have important roles to play in the transformation of voting technology, but that the most important decisions lie in the hands of state and local election officials. It suggests a legal structure that will protect basic voting rights while allowing for innovation and experimentation. Most important, the article urges that election reform no longer be viewed as a once-in-a-generation occurrence, but as an ongoing process that should proceed for as long as voting technology continues to improve.

The Paperless Chase: Electronic Voting and Democratic Values

Daniel P. Tokaji

Abstract

The 2000 election ignited a fierce controversy over the machinery used for voting. Civil rights advocates have called for the replacement of outdated paper-based voting equipment, like the infamous “hanging chad” punch card. Yet the introduction of paperless technology, especially electronic “touchscreen” machines, has induced widespread concern that software might be rigged to alter election results. This article examines the debate over electronic voting, which raises fundamental questions about the democratic values that should guide the administration of elections. It frames the debate by defining four equality norms embodied in federal voting rights laws and the Constitution. Electronic voting has the potential to advance racial equality, disability access, and multilingual access. At the same time, there are legitimate concerns surrounding the implementation of present-generation technology. The proposed “voter verified paper audit trail” is unlikely to resolve these concerns, though other measures may be taken to promote security and transparency. The article concludes that legislatures and courts have important roles to play in the transformation of voting technology, but that the most important decisions lie in the hands of state and local election officials. It suggests a legal structure that will protect basic voting rights while allowing for innovation and experimentation. Most important, the article urges that election reform no longer be viewed as a once-in-a-generation occurrence, but as an ongoing process that should proceed for as long as voting technology continues to improve.

The Paperless Chase: Electronic Voting and Democratic Values

Table of Contents

INTRODUCTION	1
I. THE STATE OF ELECTION SYSTEMS	5
A. Paper or Plastic?: Types of Voting Equipment	5
1. Hand-Counted Paper Ballots	7
2. Mechanical Lever Machines	8
3. Punch Cards Ballots	8
4. Optical Scan Ballots	10
5. Direct Record Electronic Machines	11
B. Tracing the Chase: 2000-2004	13
1. Florida 2000	14
2. Post-2000 Studies of Voting Technology	15
3. Voting Equipment in the Courts	18
4. State Legislative Responses	20
5. The Help America Vote Act	21
6. Controversy Over Electronic Voting	24
7. Voting Technology in 2004	27
II. TECHNOLOGY AND EQUALITY	29
A. Four Equality Norms	30
1. Racial Equality	30
2. Disability Access	32
3. Multi-Language Access	35
4. Inter-Jurisdictional Equality	36
B. Empirical Research on Electronic Voting	42
1. Technology and Uncounted Votes	42
a. Measuring Performance	42
b. First- and Second-Generation DREs	47
2. Race and Voting Technology	48
a. The Usage of Voting Technology	49
b. The Impact of Voting Technology	52
3. Implications of the Empirical Research	56
C. Technology and Accessibility	57
D. Tallying the Results	61
III. SECURITY, TRANSPARENCY AND ELECTRONIC VOTING	63
A. The Risks of Electronic Voting	63
1. Two More Democratic Values	63

2. Identifying Vulnerabilities	64
3. Analyzing Vulnerabilities	66
B. Is Paper the Answer?	69
1. A Comparative Perspective	69
2. Historical Problems with Paper	71
3. Problems with a Contemporaneous Paper Record ...	74
a. Practicability	74
b. Efficacy	77
C. Alternatives to Paper	80
IV. BUILDING BETTER VOTING SYSTEMS	84
A. The Judiciary	85
B. Legislative and Administrative Bodies	90
C. State and Local Election Officials	93
IV. CONCLUSION	94

APPENDIX A: SUMMARY OF STATE HAVA PLANS

APPENDIX B: SUMMMARY OF STATE RECOUNT LAWS

The Paperless Chase: Electronic Voting and Democratic Values

Daniel P. Tokaji*

INTRODUCTION

Four years after the 2000 presidential election debacle, a fierce debate still rages over the machinery used to cast and count votes. The Help America Vote Act of 2002 (“HAVA”)¹ promised major changes in the infrastructure of American democracy, including funding for the replacement of outdated voting equipment. Spurred by both legislation and litigation, states from Florida to Maryland to California have taken steps to replace the infamous “hanging chad” punch card machine with more modern – and supposedly more reliable – voting technology.²

Contrary to expectations, these changes have not ended the debate over the machinery used to cast and count votes, but have only intensified it. In 2004, some 30 million citizens will continue to vote with punch cards, similar to those used in Florida’s 2000 election.³ Voters affected by the continuing deployment of antiquated

---

*Assistant Professor, The Ohio State University, Moritz College of Law. The author has served as co-counsel in three cases challenging the use of “hanging chad” punch card machines, on the ground that their use discriminates against racial minorities and violates equal protection: *Common Cause v. Jones*, 213 F. Supp. 2d 1110 (C.D. Cal. 2002) (challenging the use of pre-scored punch card voting machine); *Southwest Voter Registration Education Project v. Shelley*, 278 F. Supp. 2d 1131 (C.D. Cal. 2003), *reversed* 344 F.3d 882 (9th Cir. 2003), *vacated* 344 F.3d 913 (9th Cir. 913), *district court affirmed*, 344 F.3d 914 (9th Cir. 2003)(en banc)(seeking to postpone California recall election on the ground that the use of punch cards would disenfranchise minority voters and deny equal protection); and *Stewart v. Blackwell*, Case No. 5:02-CV-2028 (N.D. Ohio filed Oct. 11, 2002)(challenging the use of punch card and central-count optical scan voting equipment). The views expressed are solely those of the author.

¹Pub. L. No. 107-252, 116 Stat. 1666.

²John McCarthy, *Florida Leads the Nation in Election Reform*, Florida Today, May 21, 2001 (describing Florida’s plan to decertify and replace punch card machines by 2002); Henry Weinstein, *State Ordered to Replace Old Voting Machines*, L.A. TIMES, Feb. 14, 2002, pt. 2, p. 1 (describing federal court’s ruling requiring the replacement of two types of punch card voting machines).

³Election Data Services, *New Study Shows 50 Million Voters Will Use Electronic Voting Systems, 32 Million Still with Punch Cards in 2004* (Feb. 12, 2004), available at http://216.219.161.174/EDSInc_VEstudy2004.pdf

equipment have brought lawsuits to challenge its use⁴ – including an unsuccessful attempt to postpone the California recall.⁵ In addition, citizens with disabilities have brought lawsuits challenging paper-based equipment on the ground that it fails to allow secret and independent voting.⁶

At the same time, the replacement of punch cards with electronic “touchscreen” voting machines has generated enormous anxiety in some quarters.⁷ Arguing that the present generation of touchscreen voting technology is insecure, some advocates have called for a “voter verified paper audit trail” to be required by law. This would require that all electronic voting machines generate a contemporaneous paper record (or “CPR”) of the electronically cast ballot, something that has until now been attempted by only a few jurisdictions.⁸ Electronic voting critics have also mounted legal

---

⁴See, e.g., *Black v. McGuffage*, 209 F. Supp. 2d 889 (N.D. Ill. 2002)(denying motion to dismiss African-American and Latino voters challenge to punch card ballot systems). For a summary of cases relying on the Equal Protection Clause, including the decision in *Bush v. Gore*, 531 U.S. 98 (2000), to challenge unreliable voting equipment, see Stephen J. Mulroy, *Lemonade from Lemons: Can Advocates Convert Bush v. Gore into a Vehicle for Reform*, 9 GEO. J. POVERTY LAW & POL’Y 357 (2002).

⁵*Southwest Voter Registration Education Project v. Shelley*, 344 F.3d 882 (9th Cir. 2003), *vacated* 344 F.3d 913 (9th Cir. 2003)(“SVREP”). For commentary on the SVREP decision, see Vikram David Amar, *Adventures in Direct Democracy: The Top Ten Constitutional Lessons from the California Recall Experience*, 92 CALIF. L. REV. 927 (2004); Richard L. Hasen, *The California Recall Punch Card Litigation: Why Bush v. Gore Does Not Suck* (September 2004), Loyola-LA Legal Studies Research Paper No. 2004-17, available at <http://ssrn.com/abstract=589001>; Steven Holtkamp, *Expedience v. the Public Interest: Southwest Voter Registration Education Project v. Shelley*, 31 W. STATE U. L. REV. 371 (2004); Case Comment, *Ninth Circuit Affirms Decision Not to Enjoin California Recall Election – Southwest Voter Registration Education Project v. Shelley*, 344 F.3d 914 (9th Cir. 2003)(*en banc*), 117 HARV. L. REV. 2023 (2004).

⁶See *AAPD v. Hood*, 278 F. Supp. 2d 1345 (M.D. Fla. 2003).

⁷See, e.g., Jim McElhatton, *Touch Screen Voting Faulted*, WASH. TIMES, Feb. 18, 2004, at B01 (describing concerns with the security of electronic voting systems); *A Paper Trail for Voters*, N.Y. TIMES, Dec. 8, 2003, § A, p. 28 (advocating adoption of voter-verified paper trail to address security concerns).

⁸Although proponents of this requirement generally refer to this security measure as the “voter verified paper trail” or “voter verified paper audit trail,” this article uses the term “contemporaneous paper record” or “CPR.” This is the term that the Department of Justice has used in its guidance on the subject. See Memorandum Opinion for the Principal Deputy Assistant Attorney General, Civil Rights Division, *Whether Certain Direct Record Electronic Voting Systems Comply with the Help America Vote Act and the Americans with Disabilities Act*, Oct. 10, 2003, available at www.usdoj.gov/olc/drevotingsystems.wpd.

challenges to paperless voting systems.⁹

The controversy over electronic voting pits traditional progressive allies against each other. It has resulted in a public and sometimes acrimonious conflict between civil rights organizations supporting electronic voting (such as the Leadership Conference on Civil Rights and American Association of People with Disabilities), and Democratic-leaning advocacy organizations suspicious of paperless voting (like Moveon.org and America Coming Together).¹⁰ Whatever the ultimate result of the controversy, one thing is clear: It will not be resolved imminently and certainly not in time for the 2004 elections.

This article examines the voting rights implications of the ongoing transformation of election technology. It defines the democratic values that should guide our assessment of that technology, placing special emphasis on equality of political participation – a value that I have previously argued is embedded in the First Amendment as well as the Fourteenth Amendment.¹¹ I incorporate into my analysis the substantial empirical research on voting technology conducted since 2000 which, though widely discussed among social scientists, has barely penetrated the legal and public policy discourse.

Unfortunately, the public debate over electronic voting has focused upon the potential for fraud, with little attention to voting rights protections that exist under federal law.¹² This article seeks to

---

⁹ *Weber v. Shelley*, 347 F.3d 1101 (9th Cir. 2003); *Schade v. Lamone*, C-04-97297, Sep. 1, 2004 (denying preliminary injunction in case challenging Diebold electronic voting machines); see also Rachel Konrad, *Critics Sue Electronic Voting Company*, A.P., July 11, 2004 (describing *March v. Diebold*, a whistleblower lawsuit brought against Diebold for its activities in California); Jeremy Milarsky, *Court rejects U.S. Rep. Robert Wexler's lawsuit over touch-screen voting*, SUN-SENTINEL, Aug. 7, 2004 (describing appellate court decision in *Wexler v. LePore*, brought by Florida congressman opposed to paperless electronic voting).

¹⁰ See Madaline Baran, *Progressives Split Over Electronic Voting*, NEW STANDARD, Aug. 11, 2004, available at http://newstandardnews.net/content/?action=show_item&itemid=765.

¹¹ Daniel P. Tokaji, *First Amendment Equal Protection: On Discretion Inequality, and Participation*, 101 MICH. L. REV. 2409, 2501-07 (2003) (“*First Amendment Equal Protection*”); Daniel P. Tokaji, *Political Equality After Bush v. Gore: A First Amendment Approach to Voting Rights*, in FINAL ARBITER: THE CONSEQUENCES OF BUSH V. GORE FOR LAW AND POLITICS (forthcoming); see also Abner Greene, *Is There a First Amendment Defense for Bush v. Gore?* (forthcoming).

¹² Media coverage of the electronic voting controversy has predominantly characterized it as a debate between technology experts concerned with security vulnerabilities on the one hand, and election officials concerned with administrative

add a different perspective, by putting the value of equal political participation at the center of its analysis rather than the periphery. Informed by the legal protections for the franchise that exists under the United States Constitution and federal voting rights laws, I identify four equality norms that are encompassed within the value of equal political participation: (1) racial equality, (2) multi-lingual access, (3) disability access, and (4) inter-jurisdictional equality. These four norms, I contend, should guide our assessment of different voting technologies.¹³

Organizing the debate around these equality norms yields a very different picture of the electronic voting controversy from that which has commonly been painted. Electronic voting has significant advantages over paper-based voting equipment when it comes to racial equality¹⁴ and disability accessibility.¹⁵

Equality is, of course, not the only democratic value that must be taken into consideration. The controversy over electronic voting reveals two other democratic values that demand attention: security and transparency. The best way of promoting these values, however, remains the subject of fierce debate. I therefore argue against legislation mandating any single technological solution, such as a contemporaneous paper record. Such legislation is likely to disadvantage minority, disabled, and non-English speaking voters. It can also be expected to stifle innovation, by locking in a particular type of security enhancement – one that presently appears less than ideal – while discouraging possible security enhancements that may be more effective and easier to implement.

---

burdens on the other. *See, e.g.,* Kathy Bushouse, *Having Electronic Voting Machines Print Out Ballots Draws Fire and Praise*, SUN-SENTINEL, Feb. 2, 2004; Alison Hoffman & Tim Reiterman, *State Tells Counties to Establish Paper Trail on Electronic Voting*, L.A. TIMES, Nov. 21, 2003, at B10.

¹³This is not meant to be an exclusive list of the equality principles that should govern election law generally, but instead to define the ones most pertinent to the debate over voting technology. For a discussion of core equality principles that should guide judicial decisionmaking, see generally RICHARD L. HASEN, *THE SUPREME COURT AND ELECTION LAW: JUDGING EQUALITY FROM BAKER V. CARR TO BUSH V. GORE* (2003).

¹⁴Michael Tomz & Robert P. Van Houweling, *How Does Voting Equipment Affect the Racial Gap in Uncounted Ballots?*, 47 AM. J. OF POL. SCI. 46 (2003) (finding that the use of electronic voting machines virtually eliminates the black/white gap in uncounted ballots that exists with punch card and optical scan systems).

¹⁵American Association for People with Disabilities, *Voting Technology for People with Disabilities*, (March 2003) available at <http://www.aapd-dc.org/dvpmain/votemachines/downloads/Manhattan%20voters%20experiences.pdf>.

Instead of mandating that jurisdictions embrace a solution that may not in fact solve the problem, we should recognize that the decentralization of our election systems provides an opportunity for innovation. This article therefore recommends that Congress and state legislative bodies give HAVA a chance to work. This means allowing state and local jurisdictions room to experiment with different technologies, while giving the newly created Election Assistance Administration (“EAC”) the time and resources needed to develop guidelines that will promote equality, security and transparency.

Most important, it is imperative that we stop thinking about election reform as a once-in-a-generation occurrence. Instead, we should consider the improvement of voting systems an ongoing process, in which the judicial, legislative, and executive branches of both federal and state government have important responsibilities. This process will not be complete in 2004 or any subsequent election year, but will instead continue for as long as voting technology continues to improve.

****

The article proceeds in four parts. Part I examines the infrastructure of American democracy, providing an overview of the types of voting systems currently in use and summarizing developments between 2000 and 2004. Part II assesses the extent to which different voting technologies further core equality norms, taking into account the considerable social science research conducted in the past four years. Part III considers the values of security and transparency, which have figured prominently in the debate over electronic voting. Part IV suggests how the multiple institutions with responsibilities in the area of voting technology might productively move forward to promote equality, while also ensuring the security and transparency of our voting systems.

I. THE STATE OF ELECTION SYSTEMS

A. Paper or Plastic? Types of Voting Equipment

While it is common to speak of the United States’ election system as a unitary entity, authority over elections actually lies in the hands of thousands of state, county, and municipal officials scattered throughout the country. Nationwide, there are approximately 13,000

bepress Legal Repository

local jurisdictions with responsibility for administering elections.¹⁶ The United States thus has not a single election system, but many election systems. The technology used to cast votes is, moreover, only one component of those systems.¹⁷ But it is an important component, one that can dramatically affect the right to have one's vote counted.

Making sense of the present debate over voting technology requires an understanding of the multiplicity of equipment used in different parts of the country, often varying from county to county within a state and sometimes within counties. This section describes the five basic types of voting equipment presently used in the United States. From the oldest to the most recently developed, they are: (1) hand-counted paper ballots (2) mechanical lever machines, (3) punch card ballots, (4) optical scan or "Marksense" ballots, and (5) direct record electronic or "DRE" machines.¹⁸ While there is significant variation within each of these general categories,¹⁹ all the voting equipment currently used in the United States can be placed within one of these five major categories.

As set forth below, these types of equipment vary considerably in their operation and their susceptibility to error. They

---

¹⁶See Robert Pastor, *Improving the U.S. Electoral System: Lessons from Canada and Mexico*, 3 ELECTION L.J. 584 (2004)(stating that the U.S. election system is "defunctionally decentralized, fragmented into 13,000 sovereign counties and municipalities, each one designing its own ballots, organizing its own electoral register, and counting its votes in its own way ....").

¹⁷See Douglas W. Jones, *The Evaluation of Voting Technology*, in SECURE ELECTRONIC VOTING 3 (2003).

¹⁸According to an August 2001 survey, the percentage of voters using these systems in 2000 was:

Punch card	34.4%
Optical scan	27.5
Lever	17.8
Electronic	10.7
Paper	1.3
Mixed (different equipment used within counties)	8.1

NATIONAL COMMISSION ON FEDERAL ELECTION REFORM, TO ASSURE PRIDE AND CONFIDENCE IN THE ELECTORAL PROCESS 51 (2001)("TO ASSURE PRIDE AND CONFIDENCE"); see also Michael Alvarez, et al., *Counting Ballots and the 2000 Election: What Went Wrong?*, in RETHINKING THE VOTE: THE POLITICS AND PROSPECTS OF AMERICAN ELECTORAL REFORM 34, 39 (2004).

¹⁹See David C. Kimball, *Assessing Voting Methods in 2002*, at 7 (July 2004)(hereinafter "*Voting Methods*"), available at <http://www.umsl.edu/~kimball/dkmps2.pdf>

also differ in their capacity to prevent inadvertent “overvotes” (voting for more than the allowed number of candidates). Perhaps most important, there are significant differences in the capacity of different technologies to provide feedback to voters, by notifying them of mistakes and providing an opportunity to correct such mistakes. These differences exist not only *among* these five general categories but *within* some of them.

1. *Hand-Counted Paper Ballots*

The least commonly used type of voting equipment is the old-fashioned paper ballot.²⁰ During the first century of American democracy, this was the only type of voting equipment used.²¹ Until the late 1800's, voters typically obtained pre-printed ballots with the names of the candidates for which they wished to vote.²² Vote-buying scandals led to the adoption of the Australian secret ballot, which was developed in 1856.²³ Under this system, the names of all the candidates are listed on ballots, which voters mark in privacy.²⁴

Voters using this system make marks next to the names of their preferred candidates on pieces of paper, which are then counted by hand.²⁵ Although used in 12.5% of jurisdictions in 2000, only 1.3% of people voted with hand-counted paper ballots in 2000.²⁶ They are used primarily in smaller, rural jurisdictions.²⁷ Errors can occur due to ballots that are not clearly marked, or mistakes made by

---

²⁰SURVEY RESEARCH CENTER AND INSTITUTE OF GOVERNMENTAL STUDIES, UNIVERSITY OF CALIFORNIA, BERKELEY, COUNTING ALL THE VOTES: THE PERFORMANCE OF VOTING TECHNOLOGY IN THE UNITED STATES 10 (2001)(“COUNTING ALL THE VOTES”). Although optical scan and punch card systems are also paper-based, I use the term “paper ballot” to refer to systems in which voters mark their choices on pieces of paper that are then counted by hand.

²¹ERIC A. FISHER, VOTING TECHNOLOGIES IN THE UNITED STATES: OVERVIEW AND ISSUES FOR CONGRESS 2 (2001)(hereinafter “FISHER, VOTING TECHNOLOGIES”).

²²*Id.*

²³*Id.*

²⁴ERIC A. FISHER, ELECTION REFORM AND ELECTRONIC VOTING SYSTEMS (DRES): ANALYSIS OF SECURITY ISSUES (2003)(hereinafter “FISHER, DRES”).

²⁵COUNTING ALL THE VOTES, *supra* note 20, at 10; *see also* Alvarez, *supra* note 18, at 36.

²⁶Alvarez, *supra* note 18, at 39.

²⁷CALTECH/MIT VOTING TECHNOLOGY PROJECT, VOTING: WHAT IS, WHAT COULD BE 20 (2001).

those who decipher the paper ballots.²⁸

2. *Mechanical Lever Machines*

Subsequent to the development of the Australian ballot, the first major alteration in voting technology came with the advent of the lever voting machine.²⁹ Invented in 1892, this system eliminated the possibility of tampering with paper ballots, since there is no document to tamper with.³⁰ The machines have levers next to each ballot choice.³¹ Though less common than paper-based voting equipment, lever machines were still used by 17.8% of voters nationwide in 2000³²

To cast a vote, the voter enters the voting booth and turns levers next to his or her choices. After doing so, the voter may visually confirm those choices and then pull a large lever, which counts the votes. Problems with mechanical lever machines can occur if the machines are improperly configured, or if the counters fail to register voters' choices.³³ The age of these machines, and the difficulty in obtaining replacement parts, can also lead to problems with this system. Thus, over the past two decades, many jurisdictions have abandoned them.³⁴

3. *Punch Cards Ballots*

The most common type of voting equipment in 2000 was the punch card ballot, used by 34.4% of voters nationwide.³⁵ Introduced in 1964, the punch card was the first technology to use computers to count votes.³⁶ There are two basic variants of the punch card system: pre-scored or "Votomatic" style punch card ballots (used by 30.9%

---

²⁸COUNTING ALL THE VOTES, *supra* note 20, at 10.

²⁹FISHER, VOTING TECHNOLOGIES, *supra* note 21, at 3.

³⁰*Id.*; FISHER, DRES, *supra* note 24

³¹COUNTING ALL THE VOTES, *supra* note 20, at 10.

³²TO ASSURE PRIDE AND CONFIDENCE, *supra* note 18, at 51.

³³COUNTING ALL THE VOTES, *supra* note 20, at 10.

³⁴VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 20.

³⁵*Id.*

³⁶FISHER, VOTING TECHNOLOGIES, *supra* note 24, at 3; Fisher, DRES, *supra* note 24, at 3.

of voters in 2000),³⁷ and non-pre-scored or “Datavote” punch card ballots (used by about 3.5% of voters).³⁸

Votomatic-style punch cards are the ones that became infamous during the Florida 2000 election controversy. This system relies on cards with pre-scored perforations, or “chad,” and small numbers imprinted on the card associated with each chad.³⁹ At the time of voting, the voter places the punch card in a slot at the top of the punching device. When properly placed in the device, the pre-scored perforations on the card line up with the names of candidates or ballot measures, which are printed on pages attached to the device. A stylus is used to punch through the perforations in the card, corresponding to the candidates and other choices selected by the voter. If the ballot is not placed in the correct place on the machine, then the candidates’ names or ballot choices will not line up properly, resulting in an errant or invalid vote.⁴⁰

After the voter makes his or her choices, the Votomatic punch card is placed in a box, and counted with a vote-counting machine that reads the ballot based on the passage of light through the spaces. Errors can occur if the chad is not fully removed, or is punched in the wrong place due to misalignment.⁴¹ Successive runs through the counter or handling of the ballot can cause chad to be dislodged.⁴² Also, because the candidate names and ballot choices do not appear on the punch card itself, voters cannot easily tell from looking at the ballot whether their votes were cast as intended. Votomatic style punch card systems do not allow voters to be notified of “undervotes” (not voting in a race) or “overvotes” (casting votes for more candidates than permitted in a single race).⁴³ Both undervotes and overvotes result in a ballot not being counted.⁴⁴

---

³⁷This includes the “Pollstar” system, a variant on the Votomatic used in some California counties.

³⁸Alvarez, *supra* note 18, at 39.

³⁹COUNTING ALL THE VOTES, *supra* note 20, at 12.

⁴⁰*Id.*

⁴¹*Id.*

⁴²Roy G. Saltman, *NBS Special Publication 500-158, Accuracy, Integrity, and Security in Computerized Vote-Tallying* (August 1988), available at <http://www.itl.nist.gov/lab/specpubs/500-158.htm>.

⁴³The exception is a system deployed in Cook County, Illinois, which utilized with card readers at the precinct, similar to the precinct-count optical scan system described below.

⁴⁴This article refers to “undervotes” and “overvotes” collectively as “non-votes” or “residual votes.”

The other type of punch card equipment is the Datavote. In contrast to the Votomatic punch card, the Datavote card does not have chads. Instead, the voter receives cards without pre-scored perforations. In contrast to the Votomatic system, the names of the candidates or ballot choices appear on the cards themselves. The voter inserts the card in the machine and makes his or her choice by punching a hole in the ballot, using a special mechanism that functions like a one-hole punch. The tool is mounted on a holder, so that it can move up and down and be positioned over the row to be punched. As with Votomatic-style machines, the voted ballots are placed in a box and counted with a vote-counting machine.⁴⁵

The Datavote system makes it easier for voters to “check their work” than is the case with Votomatic-style systems. Because candidate names appear next to the punched holes, it is less difficult to determine whether a hole has been made in the correct place. The downside of Datavotes is that, because the names of candidates appear on the ballots, multiple cards are often necessary in a single election. This can lead to confused voters and inadvertent undervotes, making the Datavote a less attractive option for jurisdictions with lengthy ballots. In addition, there is no mechanism for rejecting overvotes, as is possible with the precinct-count optical scan and electronic systems discussed below.⁴⁶

4. *Optical Scan Ballots*

Optical scan or “Marksense” technology has been used for decades for standardized tests, such as the SAT, optical scan equipment. It first became available for use in voting in the 1980's.⁴⁷ Optical scan ballots were used by 27.5% of United States voters in 2000, the second most commonly used type of equipment after punch cards.⁴⁸

Like the punch card ballot, the optical scan ballot is a paper-based technology that relies on computers in the counting process. Voters make their choices by using a pencil or pen to mark the ballot, typically by filling an oval or drawing a straight line to connect two parts of an arrow.⁴⁹ The ballots are counted by scanners, which may be located either at the precinct (in “precinct-count” systems) or at

---

⁴⁵COUNTING ALL THE VOTES, *supra* note 20, at 12.

⁴⁶*Id.*

⁴⁷FISHER, VOTING TECHNOLOGIES, *supra* note 21, at 4.

⁴⁸Alvarez, *supra* note 18, at 39.

⁴⁹*Id.* at 13.

some central location (“central-count” systems).⁵⁰ The significant dividing line within the category of optical scan equipment is between those that allow voters to check for errors at the precinct, and those that do not.⁵¹ Only precinct-count optical scan equipment has this capacity.

Voters using optical scan ballots may inadvertently undervote or overvote, through stray marks or the failure to use the proper type of marking device. With precinct-count systems, the ballots may be scanned by a machine before being placed in a ballot box, and the scanner programmed to notify the voter if he or she has overvoted or undervoted.⁵² Such error notification, or “second chance” voting as it is sometimes called,⁵³ may prevent voters from inadvertently marking more choices than allowed.

With central-count systems, the ballots are placed in a ballot box and sent to a central location for scanning. Second-chance voting is not possible with a central-count system.⁵⁴ Thus, central-count systems allow mistaken overvotes to occur, and cannot be programmed to notify the voter if he or she has undervoted.⁵⁵

5. *Direct Record Electronic Machines*

Electronic systems are the newest type of voting system, first introduced in the 1970s.⁵⁶ Some type of Direct Record Electronic (or “DRE”) machine was used by 10.7% of American voters in 2000. Although sometimes referred to as “e-voting,” these machines are not hooked up to the internet. DREs are instead stand-alone machines which record votes in their internal memories. The risks inherent in DRE voting must therefore be distinguished from those arising from

---

⁵⁰VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 19.

⁵¹*See, e.g.,* J. Kenneth Blackwell, Ohio Secretary of State, *Changing the Election Landscape in the State of Ohio* 26-27 (June 2003).

⁵²COUNTING ALL THE VOTES, *supra* note 20, at 13.

⁵³*See* Kimball, *supra* note 19, at 2.

⁵⁴*Id.*

⁵⁵In addition, some counties that count optical scan ballots at the precinct do not activate the error correction feature. Kimball, *supra* note 19, at 8. For simplicity, these will be treated as central-count optical scan counties in this article. *Id.*

⁵⁶Fisher, *supra* note 21, at 4.

internet voting.⁵⁷

There are two basic types of DRE systems. The first generation of DRE systems, some of which are still in use, are known as “full-face” systems because they present the entire ballot to the voter at once.⁵⁸ These machines, some of which were modeled on lever machines, typically use a push-buttons.⁵⁹ As of 2000, approximately two-third of the DRE counties used machines of the “full face” variety.⁶⁰ The more recent “second generation” models of DRE include ATM-style touchscreens – so labelled because the voter touches the screen to cast his or her vote.⁶¹ In other second-generation models, the voter turns a dial in order to cast his or her vote.⁶²

Instead of receiving a paper ballot, voters using these DRE machines typically receive a plastic card – sometimes known as a “smartcard” – at the polling place.⁶³ The voter inserts the smartcard, which looks like a thick credit card, into the voting terminal, causing the ballot to be displayed and activated.⁶⁴ The voter then makes his or her choices manually, either by touching a screen, using a dial, or pressing buttons, depending on the type of DRE machine being used.⁶⁵ With second-generation systems, the voter is typically shown a verification screen at the end of the voting process, which may be checked to confirm that the choices made are correct. At the conclusion of the voting process, the voter touches the screen or depresses a button to cast the vote.⁶⁶

---

⁵⁷Roy G. Saltman, *Auditability of Non-Ballot, Poll-Site Voting Systems* 3 (Mar. 31, 2003)(“The risks of Internet voting should not be used to taint the use of DREs by combining the latter with the former as ‘electronic voting’ and by giving the impression that the unique difficulties of Internet voting also apply to DREs.”).

⁵⁸Kimball, *Voting Methods*, *supra* note 19.

⁵⁹*Id.* at 8.

⁶⁰VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 19-20.

⁶¹COUNTING ALL THE VOTES, *supra* note 20, at 10.

⁶²An example is the “eSlate” DRE, manufactured by Hart InterCivic, in which the voter uses a wheel rather than a touchscreen to make his or her choices. See California Secretary of State, Voting Systems-Hart eSlate, available at http://www.ss.ca.gov/elections/voting_systems/eslate.htm.

⁶³See Tadayoshi Kohno, et al., *Analysis of an Electronic Voting System*, July 23, 2003, at 7, available at <http://avirubin.com/vote.pdf>; Rick DeVecchio, *Alameda County Vote Going High Tech*, S.F. CHRON., Oct. 14, 2002.

⁶⁴*Id.*

⁶⁵See Kimball, *supra* note 19.

⁶⁶COUNTING ALL THE VOTES, *supra* note 20, at 13.

As with levers, it is not generally possible to overvote with DRE voting machines, either first- or second-generation. With second-generation DREs, the names of the candidates or ballot choices appear on the screen and, at the end of the voting session, the voter may check the choices made to confirm that they are correct.⁶⁷ Second-generation DREs do not generate a paper record of the ballot at the time of voting. Instead, they the votes in electronic form, typically in multiple places within the unit.

Some of the second-generation DRE systems now available feature components that make it possible for voters with disabilities to vote independently.⁶⁸ These include an audio component for people with visual impairments or illiterate voters, and “sip and puff” devices for voters with manual dexterity limitations.⁶⁹ The more flexible interface of second-generation DRE screens also allows multiple languages to be displayed, thereby facilitating independent voting by non-English speaking voters.⁷⁰

B. Tracing the Chase: 2000-2004

The 2000 election laid bare the problems with the equipment currently used to cast votes. Yet despite an initial outpouring of interest on the part of citizens and public officials throughout the United States, and numerous studies documenting the serious problems with some of the equipment used, reform has not proceeded as expeditiously as many had hoped. Litigation and legislation have resulted in some significant changes, including the replacement of Votomatic-style punch card equipment in several states. Yet the introduction of paperless electronic voting has generated escalating controversy, leading some advocates to label them a threat to democracy.⁷¹ The consequence is that many jurisdictions, including those in some swing states, have decided to stand pat with their existing voting equipment in 2004.⁷²

---

⁶⁷COUNTING ALL THE VOTES, *supra* note 20, at 13

⁶⁸*American Ass’n of People with Disabilities v. Hood*, 278 F. Supp. 2d 1345 (M.D. Fla. 2003).

⁶⁹*Id.*; see also <http://www.hartintercivic.com/solutions/eslate.html> (Hart InterCivic website, describing accessibility features of eSlate DRE).

⁷⁰COUNTING ALL THE VOTES, *supra* note 20, at 14; VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 20.

⁷¹See, e.g., <http://www.verifiedvoting.org> (accessed August 8, 2004).

⁷²According to Election Data Services, 69% of voters in Ohio, 65% of voters in Missouri, and 59% of voters in Illinois will use punch cards in November 2004.

1. *Florida 2000*

The logical starting point for discussion of the changes in voting technology over the past four years is Florida's 2000 election. The story of this election is familiar,⁷³ and need only briefly be summarized here. With the outcome of the presidential election hanging on the Florida, and George W. Bush leading narrowly after the machine count, then-Vice President Al Gore sought manual recounts of ballots in four counties.⁷⁴ The Florida Secretary of State set a deadline of November 14 for the completion of manual recounts, later moved back to November 26 by an order of the Florida Supreme Court.⁷⁵ The United States Supreme Court vacated that order in *Bush v. Palm Beach Canvassing Board*, and the Florida Elections Canvassing Commission certified the election on November 26, with Bush prevailing by a narrow margin. Gore responded by filing a contest action pursuant to Florida law. A state circuit court denied Gore relief, but the Florida Supreme Court reversed in part, ordering a manual recount in *all* counties that had not yet conducted one.⁷⁶

That led to the opinion in *Bush v. Gore*, in which the U.S. Supreme Court held the manual recount procedure ordered by the Florida Supreme Court unconstitutional under the Equal Protection Clause.⁷⁷ What is significant about the opinion, for purposes of understanding the changes in voting technology from 2000 to 2004, is its recognition that the election exposed a serious but previously overlooked problem in need of attention. As the Court explained:

The closeness of this election, and the multitude of legal challenges which have followed in its wake, have brought into sharp focus a common, if heretofore unnoticed, phenomenon. Nationwide statistics reveal that an estimated 2% of ballots cast do not register a vote for President for whatever reason, including deliberately choosing no candidate at all or some voter error, such as voting for two candidates or

---

⁷³See, e.g., JEFFREY TOOBIN: TOO CLOSE TO CALL (2001). For a description of the litigation surrounding the 2000 presidential election, see ABNER GREENE, UNDERSTANDING THE 2000 ELECTION: A GUIDE TO THE LEGAL BATTLES THAT DECIDED THE PRESIDENCY (2001).

⁷⁴*Bush v. Palm Beach Canvassing Board*, 531 U.S. 70, 73-74 (2000).

⁷⁵*Bush v. Gore*, 531 U.S. 98, 101 (2000).

⁷⁶*Id.* at 101-03.

⁷⁷*Id.* at 104.

insufficiently marking a ballot . . . .

This case has shown that punch card balloting machines can produce an unfortunate number of ballots which are not punched in a clean, complete way by the voter. After the current counting, it is likely legislative bodies nationwide will examine ways to improve the mechanisms and machinery for voting.⁷⁸

The Supreme Court did not expressly rule on whether the use of inaccurate voting equipment, in some but not all counties within a state, violated equal protection. Nor could it have ruled on this issue, since it was not made by either side. Instead, the Court anticipated that legislative bodies would examine the problem in the months to come.

2. *Post-2000 Studies of Voting Technology*

Although previously understood by only a small cadre of experts, problems with punch card voting machines were in fact nothing new. As early as 1988, Roy Saltman of the National Bureau of Standards described at considerable length the accuracy and integrity problems with punch card voting systems.⁷⁹ In that report, Saltman found that the inaccuracies resulting from the continuing use of Votomatic-style punch card machine threatened voter confidence, and recommended that the use of this equipment be ended.⁸⁰

The reports that followed the 2000 presidential election

---

⁷⁸*Id.* at 103-04.

⁷⁹Roy G. Saltman, *NBS Special Publication 500-158, Accuracy, Integrity, and Security in Computerized Vote-Tallying* (August 1988), available at <http://www.itl.nist.gov/lab/specpubs/500-158.htm>.

⁸⁰*Id.* § 6.9.2. For an even earlier study of punch card voting equipment, see Herb Asher, et al., *The Effect of Voting Systems on Voter Participation* (prepared for delivery at the Annual Meeting of the Midwest Political Science Association, Milwaukee, Wisconsin, April 28-May 1, 1982). Prof. Asher and his colleagues found that in top-of-the-ticket races, “the punch card system depresses the number of valid votes cast,” although the system actually did better in some down-ballot races. *Id.* at 11. They also found some evidence that “the errors made with punch card voting do not occur uniformly among all population segments, but instead impact most heavily on voters in lower socioeconomic strata.” *Id.* at 12.

provided substantial empirical support for Saltman's findings.⁸¹ Shortly after the 2000 election, the United States Commission on Civil Rights undertook a thorough analysis of voting irregularities (combined overvotes and undervotes) in Florida.⁸² As part of their final report, the commission released an empirical study by Allan J. Lichtman of American University.⁸³ Professor Lichtman concluded that approximately 2.9% of all ballots cast in Florida (approximately 180,000 of 6 million) did not contain a valid vote for President. The substantial majority of these were overvotes. Lichtman found that blacks were "far more likely than non-blacks to have their ballots rejected."⁸⁴ The racial gap was especially severe in counties using punch card, and was reduced (but not eliminated) in counties with optical scan equipment that allows for errors to be corrected at the precinct level.⁸⁵

Media organizations likewise probed the incidence of uncounted votes in Florida's election, examining ballots for which no presidential vote had been registered. In November 18, 2001, the *New York Times*, *Washington Post* and *Sun-Sentinel* all released the results of their inquiry into the Florida election.⁸⁶ Looking at precinct-level data, these studies found that race, education, and income were all positively correlated with rejected ballots.

The Florida election also sparked national studies, examining the performance of different types of voting machines throughout the country. Former presidents Gerald Ford and Jimmy Carter chaired a bipartisan commission, established to look into the functioning of the

---

⁸¹See, e.g., VOTING: WHAT IS, WHAT COULD BE, *supra* note 27; CONSTITUTION PROJECT: BUILDING CONSENSUS ON ELECTION REFORM (2001); COUNTING ALL THE VOTES, *supra* note 20; To assure Pride and Confidence, *supra* note 87 (2001).

⁸²UNITED STATES COMMISSION ON CIVIL RIGHTS, VOTING IRREGULARITIES DURING THE 2000 ELECTION (2001).

⁸³Allan J. Lichtman, *Report on the Racial Impact of the Rejection of Ballots Cast in the 2000 Presidential Election in the State of Florida*, Appendix to USCCR, *supra* note 82.

⁸⁴*Id.* at 3.

⁸⁵*Id.* at 17; see also RICHARD A. POSNER, BREAKING THE DEADLOCK: THE 2000 ELECTION, THE CONSTITUTION, AND THE COURTS 67-82 (2001) (analyzing Florida 2000 overvotes and undervotes with different types of technology).

⁸⁶Sally Kestin, *The Disenfranchised: Poor, Uneducated Rejected Most in 2000 Election*, SUN-SENTINEL, Nov. 18, 2001, at 1F; Dan Keating & John Mintz, *Florida Black Ballots Affected Most in 2000; Uncounted Votes Common, Survey Finds*, WASH. POST, Nov. 13, 2001, at A3, Ford Fessenden, *Examining the Vote: The Patterns; Ballots Cast by Blacks and Older Voters Were Tossed in Far Greater Numbers*, N.Y. TIMES, Nov. 12, 2001, at A17.

nation's election systems.⁸⁷ The Carter/Ford Commission delved into various problems in the way that elections are administered, including voting technology. The commission agreed that the performance of voting equipment throughout the country was cause for concern.⁸⁸ As for electronic voting, the commission noted that early DRE systems had high rates of voter errors, which were "significantly reduced by more modern hardware and more sophisticated software designs that improve the user interface."⁸⁹ The Carter/Ford Commission did not, however, suggest the conversion to any single system. Instead, it urged setting benchmarks for reliable performance, and allow state and local election officials to determine how best to meet those benchmarks.⁹⁰

The first nationwide examination of the *racial* impact of voting technology was conducted by the minority staff of the U.S. House Committee on Government Reform. It examined 40 congressional districts in 20 states, half of which had high poverty rates and large minority populations and half of which had low poverty and small minority populations. The report found not only that voters in the low-income, high-minority districts were more likely not to have their votes counted, but also that better technology significantly reduced the gap.⁹¹ In particular, it found that some low-income, high-minority districts achieved low rates of uncounted votes, using either electronic or precinct-count optical scan technology.⁹²

A handful of legal academics turned their attention on the "nuts and bolts" of elections,⁹³ including the machinery used to cast

---

⁸⁷TASK FORCE ON THE FEDERAL ELECTION SYSTEM, NATIONAL COMMISSION ON FEDERAL ELECTION REFORM, TO ASSURE PRIDE AND CONFIDENCE IN THE ELECTORAL PROCESS (2001)

⁸⁸TO ASSURE PRIDE AND CONFIDENCE, *supra* note 87, at 55 (listing counties whose performance was deemed "worrying" or "unacceptable").

⁸⁹*Id.*

⁹⁰As a rule of thumb, the Carter/Ford Commission report recommended that the benchmark for residual vote rates in the next election cycle be set for no higher than 2%. *Id.* at 53.

⁹¹Minority Staff, Special Investigations Division, Committee on Government Reform, U.S. House of Representatives, *Income and Racial Disparities in the Undercount in the 2000 Presidential Election* (July 2001).

⁹²*Id.* at 7.

⁹³See Richard L. Hasen, *Bush v. Gore and the Future of Equal Protection Law in Elections*, 29 FLA. ST. U. L. REV. 377, 378 (2001) (pointing out that *Bush v. Gore*'s majority opinion "eviscerated the distinction between nuts-and-bolts questions and big picture questions," for purposes of Fourteenth Amendment

and count votes.⁹⁴ The most thorough consideration of the voting technology divide in the wake of the 2000 election appears in an article by Paul Schwartz, principally focused on the voting technology used in Florida's 2000 election.⁹⁵ Professor Schwartz described the empirical research, showing that election equipment providing "feedback" to the voters resulted in fewer residual votes than central-count punch card and optical scan systems that lack such feedback.⁹⁶ He found that precinct-count optical scans and lever machines, both of which provide some feedback to the voter, did best.⁹⁷ Prof. Schwartz concluded that the use of inferior technology "exacerbates the underlying racial disparity, and closing the voting-technology divide would reduce it – but not eliminate it."⁹⁸ He recommended adoption of equipment that provides feedback to voters.⁹⁹

3. *Voting Equipment in the Courts*

Relying on evidence of voting equipment problems, especially with punch cards, voting rights advocates in several states filed lawsuits seeking to require the replacement of antiquated systems.¹⁰⁰ While the specifics of these lawsuits varied, they all relied on *Bush v. Gore*, arguing that the use of different types of voting equipment with different levels of accuracy within a state violated the Fourteenth Amendment. In addition, the post-2000 lawsuits alleged that the use of unreliable voting equipment resulted in racial disparities, violating Section 2 of the Voting Rights Act.

As the dust from the 2000 election controversy began to clear, the ACLU, NAACP Legal Defense and Education Fund, and other advocacy groups brought suit on behalf of Florida to end punch card

---

analysis).

⁹⁴Stephen J. Mulroy, *Lemonade from Lemons: Can Advocates Convert Bush v. Gore Into a Vehicle for Reform?*, 9 GEO. J. POVERTY LAW & POL'Y 357 (2002).

⁹⁵Paul M. Schwartz, *Voting Technology and Democracy*, 77 N.Y.U. L. REV. 625 (2002).

⁹⁶*Id.* at 633.

⁹⁷*Id.* at 636.

⁹⁸*Id.* at 643.

⁹⁹*Id.* at 696.

¹⁰⁰*Black v. McGuffage* (N.D. Ill. Case No. 01-C-208); *NAACP v. Harris* (S.D. Fl. Case No. 01-CIV-120); *Common Cause v. Jones* (C.D. Cal. Case No. 01-3470); *Andrews v. Cox* (N.D. Ga. Case No. 01-CV-0318); *Stewart v. Blackwell* (N.D. Ohio Case No. 5:02-CV-2028).

voting.¹⁰¹ The ACLU subsequently brought lawsuits in Georgia, Illinois, California, and Ohio on similar grounds.¹⁰² In each of these lawsuits, plaintiffs argued that the continuing use of punch card voting equipment denied their rights under the Fourteenth Amendment and the Voting Rights Act. In both the California and Illinois cases, federal district court judges denied state defendants' motions for dismissal at the pleading stage.¹⁰³

In addition to the cases seeking elimination of punch card voting equipment, one case has sought postponement of an election based on disparities arising from its use. In *Southwest Voter Registration Education Project v. Shelley*, voting rights groups brought suit, seeking to postpone the October 2003 California recall until punch cards could be replaced. After the district court declined to issue a preliminary injunction postponing the recall,¹⁰⁴ a three-judge panel of the Ninth Circuit reversed and ordered the recall enjoined.¹⁰⁵ That opinion, however, was vacated one week later by the *en banc* court.¹⁰⁶ The *en banc* court did not decide whether the state's deployment of voting equipment with substantially different levels of accuracy violates equal protection.¹⁰⁷ It instead rested on the deferential standard applicable to preliminary injunctions and the harm to the State of California that would result from postponing an election that had already begun.¹⁰⁸ In effect, the court punted, leaving for another day the applicability of the Equal Protection Clause and

---

¹⁰¹*NAACP v. Harris*, No. 01-CIV-120 (S.D. Fla. filed January 10, 2001), complaint available at <http://election2000.stanford.edu/11001harris.pdf>. This case also sought to stop other practices alleged to deny the voting rights of African Americans and other voters.

¹⁰²See Tokaji, *First Amendment Equal Protection*, *supra* note 11, at 2510 & n. 499; Mulroy, *supra* note 94, at 358-61 (describing progress of litigation in California, Illinois and Georgia).

¹⁰³*Black v. McGuffage*, 209 F. Supp. 2d 889 (N.D. Ill. 2002); *Common Cause v. Jones*, 213 F. Supp. 2d 1106 (C.D. Cal. 2001). These opinions are discussed *infra* parts II.A and IV.A.

¹⁰⁴278 F. Supp. 2d 1131 (C.D. Cal. 2003).

¹⁰⁵344 F.3d 882, 896 (9th Cir. 2003).

¹⁰⁶344 F.3d 914 (9th Cir. 2003).

¹⁰⁷As one commentator has put it, the court "neither accepted nor rebutted the equal protection claim." Case Comment, *Ninth Circuit Affirms Decision Not to Enjoin California Recall Election – Southwest Voter Registration Education Project v. Shelley*, 344 F.3d 914 (9th Cir. 2003) (*en banc*), 117 HARV. L. REV. 2023, 2028 (2004).

¹⁰⁸*Id.* at 919-20. The court noted that hundreds of thousands of absentee votes had already been cast for the October 2003 recall election. *Id.* at 919.

Voting Rights Act, in cases where inaccurate voting equipment is employed.

4. *State Legislative Responses*

As lawsuits seeking to end the use of punch cards were proceeding, legislative bodies in a handful of states began to examine whether their voting systems might be improved. Florida was one of the first to act. In 2001, Governor Jeb Bush signed into law the “Florida Election Reform Act of 2001,” which banned the use of punch card ballots and required the purchase of either optical-scan or electronic voting technology by 2002.¹⁰⁹ Individual counties in Florida were left to decide which type of equipment to purchase.¹¹⁰ Florida’s law provided \$24 million for new voting equipment, with additional amounts for poll worker training, voter education, and creation of a voter registration database. Also included was a provision requiring public reports on Florida’s voting technology in each election.¹¹¹

Georgia and Maryland also enacted election reform legislation in 2001.¹¹² Unlike Florida, both of these states made the decision to move to uniform voting technology. Until 2000, Georgia had used a variety of different voting equipment, including punch cards, optical scans, lever machines, and paper ballots, which resulted in widely divergent residual vote rates across the state.¹¹³ Its 2001 legislation required uniformity in technology,¹¹⁴ and the state implemented DRE technology statewide for the 2002 elections.¹¹⁵ Maryland’s legislation also required uniformity in voting technology.¹¹⁶ And like Georgia, Maryland converted to DRE equipment.

In March 2002, California voters narrowly approved

---

¹⁰⁹2001 Fla. Sess. Law. Serv. 2001-40, *codified at* Fla. Stat. § 101.031.

¹¹⁰*See* Schwartz, *supra* note 95, at 694. Florida made this decision, despite the recommendation of a state task force recommending that it move to uniform technology statewide. Governor’s Select Task Force on Election Procedures, Standards and Technology, *Revitalizing Democracy in Florida* (2001).

¹¹¹Fla. Stat. § 101.595.

¹¹²Md. H.B. 1457 (2001); Ga. S. Bill 213 (2001).

¹¹³Secretary of State Cathy Cox, *Analysis of Undervote Performance of Georgia’s Uniform Electronic Voting System*, *available at* <http://www.sos.state.ga.us/pressrel/undervoteanalysis.htm>, (2003).

¹¹⁴Ga. Code. § 21-2-300.

¹¹⁵Cox, *Analysis of Undervote Performance*, *supra* note 113.

¹¹⁶Md. Ann. Code § 9-101.

Proposition 41, the Voting Modernization Bond Act of 2002.¹¹⁷ The law made available \$200 million to allow counties to purchase updated voting equipment.¹¹⁸ The law did not mandate uniformity of voting equipment statewide, nor did it require the replacement of punch cards or any other particular type of voting equipment. Anticipating the “paper trail” controversy that would later erupt over electronic voting, Proposition 41 provided that any voting system that did not require voter to mark their ballots must produce “a paper version or representation of the voted ballot or of all the ballots cast ...”¹¹⁹ The law did not require that this paper record be printed out *at the time of voting*. Rather, it allowed the paper printout to be generated either “at the time the voter votes his or her ballot *or* at the time the polls are closed.”¹²⁰ Thus, the California law required that any electronic equipment purchased with state funds print out a paper record, though not necessarily a *contemporaneous* paper record, of the electronically voted ballot.

5. *The Help America Vote Act*

Although Congress began considering legislation to overhaul the nation’s election system in early 2001,¹²¹ the Help America Vote Act (“HAVA”) was not actually signed into law until October 29, 2002.¹²² Enactment of what would ultimately become HAVA was slowed by partisan disagreements over several facets of the bill. Among them was whether or not to set minimum standards for voting equipment, that all systems must meet, with Democrats pressing for mandates and Republicans arguing against them.¹²³

The legislation eventually enacted sets modest mandates for voting systems, while attempting to give the states incentives to

---

¹¹⁷Codified at Cal. Elections Code § 19230 *et seq.*; see Julie Tamaki, et al., *Election 2002: New Challenge to Legislative Term Limits Vowed; Propositions: Teachers union suffers upset on sales tax measure despite extensive advertising against it*, Mar. 7, 2002, pt. 2, at 7 (reporting that Proposition 41 received 51.5% of the vote).

¹¹⁸Cal. Elections Code § 19233.

¹¹⁹Cal. Elections Code § 19234(e).

¹²⁰*Id.*

¹²¹John Cochran, *Voting Systems Challenged*, C.Q. WEEKLY, Apr. 231, 2001, at 865.

¹²²Pub. L. No. 107-252, 116 Stat. 1666.

¹²³See David Mark, *With Next Election Only a Year Away, Proponents of Ballot Overhaul Focus Their Hopes on 2004*, C.Q. WEEKLY, Oct. 27, 2001, at 2532.

upgrade to better technology.¹²⁴ HAVA does not require the replacement of punch cards, or any other specific type of voting equipment. To the contrary, it includes a provision specifically stating that it shall *not* be interpreted to prohibit jurisdictions from using the same kind of voting equipment that they had in November 2000.¹²⁵ Instead, HAVA provides funds for the replacement of punch card and lever systems, while imposing some general requirements that all voting systems must meet.

Title I of HAVA authorizes \$650 million in payments to the states, half of which is for the replacement of punch card ballots and lever voting machines.¹²⁶ States that choose to receive payments under Title I are obligated to replace their punch card and lever voting equipment by November 2004, although this deadline may be extended for good cause until 2006.¹²⁷ As of January 2004 a total of 24 states had sought such a waiver.¹²⁸

Title III prescribes standards that all voting equipment must meet. It states that, by January 1, 2006, voting systems allow voters to verify their choices and provide them the opportunity to correct their choices, before votes are cast.¹²⁹ Voting systems must also notify voters of overvotes. While this provision would appear to ban many current systems, HAVA takes away with one hand what it seems to give with the other. The act provides that jurisdictions using paper-based systems (such as punch cards) may meet the “notice” requirement through a voter education program that gives instructions on how to correct mistakes and informs voters of the effect of overvoting.¹³⁰ Thus, HAVA does *not* actually require that voting systems provide actual notice and the opportunity to correct mistakes.

HAVA does require that all voting systems have an “audit capacity,” and that they produce a “permanent paper record” that can be used for manual audits – though not the *contemporaneous* paper record that some advocates would later demand.¹³¹ People with

---

¹²⁴See Karen Foerstel, *Deal Reached in House on Ballot Overhaul*, C.Q. Weekly, Nov. 10, 2001, at 2670.

¹²⁵42 U.S.C. § 15481(c)(1).

¹²⁶42 U.S.C. § 15304(a); Leonard M. Shamhon, *Implementing the Help America Vote Act*, 3 ELECTION L.J. 424, 428 (2004).

¹²⁷*Id.*

¹²⁸ELECTIONLINE.ORG, WHAT’S CHANGED, WHAT HASN’T, AND WHY (2004)

¹²⁹42 U.S.C. § 15481(a)(1)(A).

¹³⁰42 U.S.C. § 15482(a)(1)(B).

¹³¹42 U.S.C. § 15482(a)(2)(A)&(B).

disabilities must also be accommodated, through voting machines that “provide[] the same opportunity for access and participation (including privacy and independence) as for other voters.”¹³² Jurisdictions can meet this requirement by providing at least one direct record electronic (“DRE”) unit or other accessible voting machine in each polling place.¹³³ Voting systems must also allow alternative language access, for people whose primary language is not English.¹³⁴

HAVA entrusts significant responsibilities in the area of voting technology to the Election Assistance Commission (“EAC”), a four-member body created by the act, and to related boards created by the act.¹³⁵ Among the EAC’s responsibilities are to administer the “requirements payments” to the states, provided for under Title II of the act.¹³⁶ A total of \$3 billion in requirements payments are authorized for distribution to states under Title II for fiscal years 2003 through 2005.¹³⁷ These monies are to be used for meeting HAVA’s requirements, which include not only voting equipment but also the creation of a statewide voter registration database, implementation of provisional voting, and effectuation of HAVA’s mandate that certain first-time voters provide identification at the polling place.¹³⁸

In sum, HAVA provides substantial funding to upgrade voting technology and make other improvements in voting systems. But it provides only modest guidance on what type of voting equipment should be implemented, with few binding mandates. Many of the details are left to the states and counties. States that Title I funds for the buyout of punch cards and lever machines must get rid of this equipment, but the law does not require the implementation of electronic voting or any other particular type of equipment – except to say that, by 2006, at least one DRE machine or other accessible unit be made available at each polling place.¹³⁹

---

¹³²42 U.S.C. § 15481(a)(3)(A).

¹³³42 U.S.C. § 15481(a)(3)(B).

¹³⁴42 U.S.C. § 15481(a)(4).

¹³⁵42 U.S.C. § 15341.

¹³⁶42 U.S.C. § 15402.

¹³⁷42 U.S.C. § 15407(a).

¹³⁸42 U.S.C. § 15407. These HAVA requirements can be found at 42 U.S.C. §§ 15482-83. Although my focus here is on HAVA’s provisions relating to voting technology, a forthcoming article (to be published in the *George Washington University Law Review*) deals with the equal protection implications of HAVA’s provisions regarding registration, provisional voting, and the ID requirement.

¹³⁹42 U.S.C. § 15481(a)(3).

6. *Controversy Over Electronic Voting*

Congress was aware of the security issues surrounding electronic voting at the time it enacted HAVA, as evinced by its inclusion of a requirement that there be a paper audit trail¹⁴⁰ and by its provision for further study of security problems.¹⁴¹ It could not, however, have anticipated the outpouring of anxiety that the implementation of electronic voting has induced.

Since 2002, the security of DRE voting equipment has come under intense scrutiny, generating a heated public debate that has spilled from computer scientists' websites¹⁴² onto the editorial pages of several major newspapers.¹⁴³ The debate has focused on "touchscreens" and other second-generation voting equipment. DRE skeptics argue that they are unduly susceptible to fraud and error.

While some had raised concerns about DRE security before HAVA's passage,¹⁴⁴ the controversy over paperless electronic voting reached a fever pitch in 2003. Professor David Dill of Stanford University's computer science department led the charge, arguing that paperless DRE voting machines are error prone and vulnerable to fraud.¹⁴⁵ As summed up in a website started by Professor Dill: "[E]lection technology has not advanced to the point where it can provide us with electronic systems that are reliable enough to trust with our democracy. In other words, we just aren't there yet."¹⁴⁶

These concerns assumed new prominence with a 2003 study

---

¹⁴⁰42 U.S.C. § 15481(a)(2).

¹⁴¹See 42 U.S.C. § 15381(a)(2).

¹⁴²See <http://verify.stanford.edu> (website of Stanford voter verification group led by Prof. David Dill).

¹⁴³THE CENTURY FOUNDATION & ELECTIONLINE.ORG, PRIMARY EDUCATION: ELECTION REFORM AND THE 2004 PRESIDENTIAL RACE 13 (2004), available at <http://www.electionline.org/site/docs/pdf/Primary%20Education.PDF>. See also, *Pointless Paper Chase*, PHIL. INQUIRER, Feb. 8, 2004 (opposing proposal to require CPR); *A Paper Trail for Voters*, N.Y. TIMES, Dec. 8, 2003 (supporting legislation to require CPR).

¹⁴⁴For example, the Caltech/MIT Voting Technology Project's report noted that it "extremely important" that election officials be able to conduct a reliable audit, and that first-generation DREs offer "no auditability." But the VTP report also noted that second-generation DREs produce an "internal paper tape ... and an electronic recording of every voting session," that should allow election officials to reconstruct the voting process and conduct a meaningful audit. VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 24.

¹⁴⁵<http://www.verifiedvoting.org>.

¹⁴⁶*Id.*

analyzing the source code used on Diebold's DRE system.¹⁴⁷ Diebold was the vendor awarded contracts to install DRE systems statewide in both Georgia and Maryland. Four computer scientists, including Professor Avi Rubin of Johns Hopkins University, conducted an analysis of the source code used in that system.¹⁴⁸ This report (hereinafter the "Hopkins Report") concluded that the source code had security flaws that could allow election workers, voters, software developers, or hackers to tamper with elections.¹⁴⁹

The Hopkins Report fueled calls for state and federal legislation to require a "voter verified paper audit trail" or "VVPAT." to Comply with such a requirement, electronic voting machines would have to be equipped with attached printers capable of generating a contemporaneous paper record ("CPR") of the electronic ballot. As noted above, HAVA requires that, by 2006, all voting equipment produce a "permanent paper record with a manual audit capacity."¹⁵⁰ It does not, however, require that this paper record be produced *at the time of voting*. The concern expressed by some DRE skeptics is that, without such a record, malicious code in the DREs software could result in the voter seeing one thing on the screen, while a different choice is recorded in the DRE's memory. Thus, if the paper record is printed out after the fact, it might not accurately reflect the voters' choices.¹⁵¹ A *contemporaneously* generated paper record would, it is argued, eliminate this possibility. If there is a discrepancy between the paper record and the intended choices, then the voter could either revise her choices or call the discrepancy to the attention of the pollworker. If a candidate or voter suspected foul play, then a recount of the paper records could be conducted. At least in theory, the CPR would provide a reliable and auditable record of voters' intended choices.¹⁵²

Due to the possibility of fraud and error with paperless electronic machines, a growing group of advocates, technologists, and editorial pages have argued that the CPR is needed to promote public confidence in electronic voting.¹⁵³ Supporters argue that this device

---

¹⁴⁷See Fisher, *DREs*, *supra* note 24, at 8-9.

¹⁴⁸Kohno, et al., *supra* note 63; *see also* Aviel D. Rubin, *Testimony*, U.S. Election Assistance Commission, May 5, 2004.

¹⁴⁹The findings and conclusions of the HAVA report are analyzed in greater detail *infra*, part III.

¹⁵⁰42 U.S.C. § 15481(a)(2).

¹⁵¹See Kohno, *supra* note 63.

¹⁵²See Fisher, *supra* note 24, at 28-29.

¹⁵³See www.verifiedvoting.org.

is essential for use in the event of a recount.¹⁵⁴ Others have called for a complete ban on electronic voting.¹⁵⁵ Although there has been no documented instance of any fraud or attempted fraud with these machines,¹⁵⁶ these concerns have cast a cloud over efforts to move to paperless DRE systems. In California, they prompted the Secretary of State to convene a task force which considered the security vulnerabilities of electronic voting,¹⁵⁷ and ultimately led to conditional decertification of the DRE machines used in that state.¹⁵⁸

On the other hand, many election officials and some civil rights advocates have opposed a CPR requirement, arguing that it is unnecessary, burdensome, and likely to discourage adoption of accessible voting technology.¹⁵⁹ The four principal co-sponsors of HAVA have also opposed imposition of a CPR requirement.¹⁶⁰

At least seven states have nevertheless announced their plans to implement the CPR, with one state (Ohio) enacting a law requiring a “voter verified paper audit trail.”¹⁶¹ Lawsuits have been filed in

---

¹⁵⁴See <http://www.verifiedvoting.org> (arguing that electronic voting systems are insecure and advocating adoption of voter verified audit trail).

¹⁵⁵Ian Hoffman, *Lawmakers Press Against Touchscreens*, OAKLAND TRIB., Mar. 12, 2004 (describing efforts of California senators to stop the use of electronic voting machines).

¹⁵⁶California Secretary of State Kevin Shelley, *Ad Hoc Touch Screen Task Force Report* 18 (2003)(“[T]he Task Force agrees that there is no proven instance of such an attempt at fraud that has happened in the number of years that DRE voting equipment has been in use.”).

¹⁵⁷*Id.*

¹⁵⁸See Decertification and Withdrawal of Approval for Certain DRE Voting Systems and Conditional Approval of the Use of Certain DRE Voting Systems (Apr. 30, 2004), available at http://www.ss.ca.gov/elections/ks_dre_papers/decert1.pdf.

¹⁵⁹See *Pointless Paper Chase*, *supra* note 143.

¹⁶⁰See “Dear Colleague” Letter from Ney, Hoyer, McConnell, and Dodd, Mar. 3, 2004, available at <http://www.house.gov/cha/dearcolleaguemarch3-04.htm>.

¹⁶¹H.B. 262; see also Steven Levy, *Ballot Boxes Go High Tech*, NEWSWEEK, Mar. 29, 2004, available at <http://msnbc.msn.com/id/4570339/> (stating that California and six other states have moved to require CPR); *Position Paper and Directives of California Secretary of State Kevin Shelley Regarding the Deployment of DRE Voting Systems in California* (Nov. 1, 2003), available at http://www.ss.ca.gov/elections/ks_dre_papers/ks_ts_response_policy_paper.pdf (mandating implementation of CPR by July 1, 2006); *Secretary of State Heller Announces Direct Electronic Voting Machine Choice* (November 10, 2003), available at <http://sos.state.nv.us/press/121003.htm> (announcing Nevada’s decision to purchase DRE machines with voter verifiable paper printout for 2004 elections).

three states, challenging the use of paperless DRE technology.¹⁶² At present, then, the controversy over electronic voting, including the question of whether a CPR should be required, remains very much unresolved.

7. *Voting Technology in 2004*

While substantial changes in the equipment used for voting have occurred in the past four years, most voters will continue to use the same equipment. Appendix A summarizes each state's HAVA plan, in the area of voting equipment. It shows that most states are planning on using HAVA monies to make significant changes to their voting equipment.

Nevertheless, three-quarters of voters nationwide will be using the same equipment that they used in 2000.¹⁶³ The percentage of voters expected to use each type of technology in 2004 (with 2000 figures given for comparison) is as follows:

	<u>2000</u>	<u>2004</u>
Punch card	34.4%	12.4%
Optical scan	27.5	34.9
Lever	17.8	14.0
Electronic	10.7	29.4
Paper	1.3	0.66
Mixed	8.1	7.4 ¹⁶⁴

Just over a third of the voters who used punch cards in 2000 will still be using that equipment. At the same time, the percentage of voters using DREs has almost tripled, though fewer voters will vote electronically than will use optical scan equipment. Despite these changes, a majority of voters in several states (including Ohio, Missouri, Illinois and Utah) will continue to use punch cards in 2004. HAVA has thus produced significant changes, but has not effected the complete overhaul of voting equipment that some expected.

---

¹⁶²*Wexler v. Hood* (Fla. filed January 2004); *Schade v. Md. State Bd. of Elections* (Md. filed Apr. 21, 2004); *March v. Diebold* (Cal. filed July 11, 2004), summarized at <http://www.verifiedvoting.org/legal>.

¹⁶³Jim Drinker, *Remember Chads? They've Hung Around*, USA TODAY, July 13, 2004.

¹⁶⁴Election Data Services, Voting Equipment Summary by Type as of: 11/02/2004, available at http://www.electiondataservices.com/VotingSummary2004_20040805.pdf. The 2000 figures are from TO ASSURE PRIDE AND CONFIDENCE, *supra* note 18, at 51. "Mixed" refers to voters living in counties that use more than one type of voting equipment for in-precinct voting.

There are at least two reasons for the less-than-complete transformation of voting technology between 2000 and 2004. The first is the delay in making federal funds available to states and counties for the replacement of existing equipment.¹⁶⁵ This was partly the result of President George W. Bush's failure to appoint the four EAC commissioners on the timetable contemplated by HAVA. Although HAVA set a deadline of February 26, 2003, the nominations were not formally made until October 3, 2003 and the commissioners were not confirmed until October 28, 2003.¹⁶⁶ In addition, Congress appropriated only \$833 million of the \$1.4 billion in HAVA in Title II money that Congress authorized for fiscal year 2003.¹⁶⁷ This shortfall was made up for with a larger fiscal year 2004 appropriation, but the delay in receiving these funds caused states – many of which were already facing revenue shortages – to be cautious in moving forward.¹⁶⁸

The second reason for the delay in replacing existing voting equipment has been the controversy over electronic voting.¹⁶⁹ The questions surrounding DRE security largely arose after the completion of the major commission studies. The lack of certainty as to its resolution, and in particular the “paper trail” controversy, has caused hesitation among election officials considering whether to purchase new equipment.¹⁷⁰

In Ohio, for example, plans to rid the state of punch cards in time for the 2004 election were abandoned, as the result of a report finding numerous security concerns.¹⁷¹ The legislature's subsequent decision to require a VVPAT further delayed the replacement of punch cards in Ohio, with almost all counties deciding to stand pat with punch cards in 2004 rather than convert to electronic voting. Only four of the 31 counties eligible to make the shift by 2004 elected

---

¹⁶⁵See Shambon, *supra* note 126, at 437-38; Thomas Hargrove, *Quarter of Voters Will Use Unreliable Machines*, SCRIPPS HOWARD NEWS SERVICE, June 21, 2004, available at <http://www.knoxstudio.com/shns/story.cfm?pk=MISCOUNT-06-21-04&cat=PP>.

¹⁶⁶ELECTIONLINE.ORG, *What's Changed*, *supra* note 128, at 20-21.

¹⁶⁷Shambon, *supra* note 126, at 437.

¹⁶⁸ELECTIONLINE.ORG, *What's Changed*, *supra* note 128, at 22; see also Shambon, *supra* note 126, at 438.

¹⁶⁹Shambon, *supra* note 126, at 438.

¹⁷⁰*Id.* at 439.

¹⁷¹ELECTIONLINE.ORG, *What's Changed*, *supra* note 128, at 16.

to do so.¹⁷² Subsequently, three of those four counties were forced to keep using punch cards when the Ohio Secretary of State decided not to allow the use of the Diebold's DRE machine, due to security concerns.¹⁷³

DRE skeptics have mounted an intensive and organized effort to monitor any problems that occur with electronic voting equipment. Some election officials to express concerns that these advocates, in their zeal to find security flaws in DRE technology, may actually worsen those problems. In Florida, for example, election officials have expressed concern that some anti-DRE groups have encouraged their members to "infiltrate the ranks of poll workers to report back to partisan groups."¹⁷⁴ Anti-DRE groups acknowledge that many of their members will be working as poll workers, but insist that they are being instructed to fulfill their duties first.¹⁷⁵ Nevertheless, the possibility of tampering with DREs – whether by DRE critics seeking to prove their point, or by those intent on engaging in foul play – has many election observers on edge.

II. TECHNOLOGY AND EQUALITY

Having described the current state of voting technology in the United States, I now turn to an assessment of how well different types of equipment protect and advance equality. In contrast to much of the public discourse surrounding voting technology, my starting point is to define four equality norms embodied in the Constitution and federal voting rights laws. Viewing the voting technology debate in light of these equality norms reveals serious deficiencies in existing paper-based equipment, including not only punch cards but also optical scan ballots. The continuing use of such equipment is inconsistent with these norms, and may well violate the statutory and constitutional requirements applicable to the vote. On the other hand, the present generation of electronic voting equipment can do much better. In particular, DREs can reduce uncounted votes and virtually eliminate the "racial gap" that tends to exist with other types of equipment. They can also expand access for people with disabilities and for voters with limited English proficiency.

---

¹⁷²Jim Provance, *4 Counties Adopt Electronic Voting*, TOLEDO BLADE, June 8, 2004.

¹⁷³John McCarthy, *Electronic Voting on Hold*, CINCINNATI ENQUIRER, July 17, 2004.

¹⁷⁴Luis F. Perez, *Florida Poll Getting Unprecedented Lesson on How to Master Disaster*, SUN-SENTINEL, Aug. 7, 2004.

¹⁷⁵*Id.*

A. Four Equality Norms

Embodied in federal voting rights laws and the U.S. Constitution are four equality norms that should guide the assessment of available voting technologies. *First*, under Section 2 of the Voting Rights Act, jurisdictions may not employ election practices that result in vote denial on account of race.¹⁷⁶ *Second*, under both the Americans with Disabilities Act and the Help America Vote Act, election officials must provide equal access to people with disabilities.¹⁷⁷ *Third*, the Voting Rights Act and HAVA protect language minorities, by requiring that voting materials be provided in languages other than English where there are significant numbers of non-English proficient citizens residing in a state or political subdivision.¹⁷⁸ *Fourth*, the Equal Protection Clause stands for the principle that equal weight be given to each vote and equal dignity accorded to each voter.¹⁷⁹ While the precise scope of this principle remains a matter of considerable controversy, at the very least it forbids election practices that accord substantially less favorable treatment to voters based upon their place of residence.¹⁸⁰ Taken together, these laws not only furnish a floor beyond which jurisdictions should fall below, but also supply goals that we should seek to achieve in choosing among available voting technologies.¹⁸¹

1. *Racial Equality*

---

¹⁷⁶See *Farrakhan v. Washington*, 338 F.3d 1009 (9th Cir. 2003).

¹⁷⁷See *AAPD v. Hood*, 278 F. Supp. 2d 1345 (M.D. Fla. 2003).

¹⁷⁸See 42 U.S.C. § 1973aa-1a.

¹⁷⁹*Bush v. Gore*, 531 U.S. 98, 104 (2001).

¹⁸⁰See, e.g., *Reynolds v. Sims*.

¹⁸¹Prof. Hasen describes three core equality principles that should guide judicial intervention on constitutional grounds. HASEN, *supra* note 4, at 81-92. Equality claims that fall outside of the core, he argues, should come from legislative bodies rather than the judiciary. The approach taken in this article differs from that of Prof. Hasen, in that my focus is on *statutory* norms, as well as constitutional equality norms. The equality norms upon which I focus here nevertheless could be categorized as falling within the “essential political rights principle” that he defines as encompassing the right not to be denied the right to vote on the basis of characteristics such as race, gender, literacy and national origin. *Id.* at 82-86. This is not to deny the other two equality principles that Prof. Hasen discusses (anti plutocracy and collective action); however, these principles do not appear to be particularly germane to the debate over voting technology. In addition, my focus is not simply – and in fact not principally – on what courts should do to protect these equality norms, but also on what legislative bodies, administrative agencies, and election officials should do to promote them.

The first legal norm germane to the debate over voting technology is racial equality. This norm is embodied in the Voting Rights Act of 1965, which prohibits state and local governments from engaging in voting practices that result in the denial or dilution of minority votes. Specifically, Section 2 of the VRA provides:

No voting qualification or prerequisite to voting or standard, practice, or procedure shall be imposed or applied by any State or political subdivision in a manner which results in a denial or abridgement of the right of any citizen of the United States to vote on account of race or color....¹⁸²

The Act specifically provides that all actions “necessary to make a vote effective,” including “casting a ballot and having such ballot counted properly,” are covered.¹⁸³ Courts are to examine the “totality of circumstances” in determining whether there has been a violation of Section 2.¹⁸⁴

Section 2 has been interpreted to prohibit not only practices that are *intended* to discriminate against minority voters, but also those that have the *result* of denying or diluting minority voters’ power.¹⁸⁵ There must be a causal connection between the challenged election practice and the racially discriminatory result.¹⁸⁶ Thus, to the extent that the use of voting systems threatens to deny racial equality, they may violate Section 2 of the Voting Rights Act.

Three federal district courts have held that a Section 2 violation may be shown, where the use of certain voting equipment results in the disproportionate denial of minority votes. Two of them are post-*Bush v. Gore* challenges to punch cards. In *Black v. McGuffage*, the court denied a motion to dismiss a Section 2 claim by Illinois voters, challenging the use of punch card voting systems.¹⁸⁷ And in *Common Cause v. Jones*, the court refused to dismiss a similar challenge, alleging that voters of color were disproportionately denied their voting rights due to the use of punch cards.¹⁸⁸ The other case is

---

¹⁸²42 U.S.C. §1973(a).

¹⁸³42 U.S.C. § 1973l(c)(1).

¹⁸⁴42 U.S.C. §1973(b).

¹⁸⁵*Thornburgh v. Gingles*, 478 U.S. 30, 35 (1986); *Farrakhan*, 338 F.3d 1009 (9th Cir. 2003).

¹⁸⁶*Farrakhan*, 338 U.S. at 1016-20.

¹⁸⁷209 F. Supp. 2d at 896-97.

¹⁸⁸213 F. Supp. 2d at 1110.

Roberts v. Wamser,¹⁸⁹ a 1987 challenge to the implementation of punch card voting equipment in St. Louis. Although later reversed by the Eighth Circuit for lack of standing,¹⁹⁰ the district court in *Roberts* held that the failure to manually review punch card ballots had a disproportionate impact on African American voters.

In each of these cases, the parties have disputed how Section 2's "totality of the circumstances" test should be applied in the context of voting equipment challenges. No appellate court has yet ruled on the merits of a Section 2 case, arising from the use of voting equipment that has a disparate impact on voters of color.¹⁹¹ There is, accordingly, some uncertainty as to the precise legal standard that ought to apply in this context. Nevertheless, there can be little question that voting technology that "result[s] in" the disproportionate denial of minority votes can violate Section 2, at least in some circumstances. Whatever the precise standard governing Section 2 claims in this area, the goal of avoiding the disproportionate denial of minority votes is one that must be taken into consideration, in assessing different types of voting technology.

2. *Disability Access*

The second equality norm that should be considered in assessing voting technologies is accessibility to citizens with disabilities. There are two main federal statutes that incorporate this norm: the Americans with Disabilities Act of 1990 ("ADA") and the Help America Vote Act ("HAVA").¹⁹²

The ADA prohibits discrimination against people with disabilities in numerous aspects of public life, including the voting process. Title II of the ADA forbids the exclusion of people with

---

¹⁸⁹679 F. Supp. 1513 (E.D. Mo. 1987).

¹⁹⁰883 F.2d 617 (8th Cir. 1989).

¹⁹¹See *SVREP v. Shelley*, 344 F.3d 914 (9th Cir. 2003). Without expressly ruling on the Section 2 claim, the *en banc* Ninth Circuit in *SVREP* indicated its view that this claim was stronger than the equal protection claim against punch card voting machines.

¹⁹²Three other statutes also address disability access in the context of voting, but provide more limited protection. The Voting Rights Act requires that voters requiring assistance due to a disability be given that assistance by persons of their choice. 42 U.S.C. § 1973aa-6. The Voting Accessibility for Elderly and Handicapped Act requires that polling places be accessible, but does not specifically address the technology used for voting. 42 U.S.C. § 1973ee. Finally, Section 504 of the Rehabilitation Act of 1973 prohibits the exclusion of people with disabilities from activities receiving federal funding. 29 U.S.C. § 794.

disabilities from services, programs, or activities of public entities.¹⁹³ At the time it enacted the ADA, Congress specifically found that voting was one of the areas in which discrimination against people with disabilities persisted.¹⁹⁴

As Michael Waterstone has suggested, the ADA can be interpreted as requiring “secret and independent” voting for people with disabilities.¹⁹⁵ Courts and administrative agencies have not generally found that the ADA confers an unqualified right for voters with disabilities to vote without assistance.¹⁹⁶ That, however, is likely to do the nascent state of voting technology that can effectively accommodate people with disabilities.

In two states, disabled citizens have brought suit under the ADA, challenging the failure to provide accessible voting technology. In *American Association of People with Disabilities v. Hood*, individuals with disabilities brought a class action against Duval County, Florida officials, asserting that the failure to provide DRE voting systems violated their rights under the ADA.¹⁹⁷ Plaintiffs argued that the paper-based systems used by the county did not allow people with visual and dexterity limitations to vote independently. They cited regulations promulgated under the ADA specifically protect the right to communication and auxiliary aids.¹⁹⁸

Relying on Title II and the regulations promulgated under that statute, the district court ruled:

[W]hile the ADA and the Rehabilitation Act do not necessarily create a comprehensive federal right to vote without assistance, the application of the ADA and the Rehabilitation Act in a particular case may

---

¹⁹³42 U.S.C. § 12132.

¹⁹⁴42 U.S.C. § 12101(a)(3); *see also* Staff of Senate Subcomm. on Handicapped of the Comm. on Labor and Human Resources and Staff of House Subcomm. on Select Educ. Of Comm. on Educ. & Labor, 101st Cong., The Americans with Disabilities Act 941 (A&P ADA Comm. Print 1990 (28B))(statement of Rep. Tony Coelho)(noting that “every sphere of life” including the “ability .... to vote” is affected by disability discrimination).

¹⁹⁵Michael Waterstone, *Constitutional and Statutory Voting Rights for People with Disabilities*, 14 STAN. L. & POL’Y REV. 353, 360 (2003).

¹⁹⁶Waterstone further argues that there may also be a constitutional right of equal access for people with disabilities, under the Equal Protection Clause of the Fourteenth Amendment. *Id.* at 369-76.

¹⁹⁷278 F. Supp. 2d 1345 (M.D. Fla. 2003).

¹⁹⁸28 C.F.R. § 35.160.

have the effect of requiring equipment that allows voters to vote without assistance.¹⁹⁹

In so holding, the district court expressly rejected suggestions that language in the Voting Rights Act or HAVA could be interpreted to absolve public entities of their responsibilities under the ADA.

In a subsequent opinion, the *AAPD v. Hood* court granted declaratory judgment against counties failing to provide accessible voting equipment.²⁰⁰ The court found that it was technologically feasible to provide accessible equipment – and specifically, that touchscreen DRE systems had the capacity to allow visually and manually impaired citizens to vote without assistance. Under this decision, counties may be subjected to liability under the ADA, if they fail to provide equipment that allows people with disabilities to vote independently.

On the other hand, a California federal court recently denied a temporary restraining order application sought by people with disabilities under the ADA.²⁰¹ While agreeing that Title II of the ADA covers the vote, the court disagreed with plaintiffs' contention that it protected the right to vote "independently and secretly."²⁰² The court provides little in the way of explanation – perhaps because of the early stage in proceedings – to support its conclusion that the right to cast a secret and independent ballot falls outside the scope of the ADA.

Whatever the ADA's scope when it comes to voting, accessible technology will have to be provided by 2006. HAVA requires that voting systems "be accessible for individuals with disabilities, including nonvisual accessibility for the blind and visually impaired, in a manner that provides the same opportunity for access and participation (including privacy and participation) as for other voters."²⁰³ This provision may be met by having at least one DRE or other voting system equipped for persons with disabilities at each polling place.²⁰⁴ This requirement becomes effective January 1, 2006.²⁰⁵ Furthermore, any equipment purchased with funds made available under Title II of HAVA must be accessible to people with

---

¹⁹⁹*Id.*

²⁰⁰310 F. Supp. 2d 1226 (M.D. Fla. 2004).

²⁰¹324 F. Supp. 2d 1120 (C.D. Cal. 2004).

²⁰²*Id.*

²⁰³42 U.S.C. § 15481(a)(3)(A).

²⁰⁴42 U.S.C. § 15481(a)(3)(B).

²⁰⁵*Id.*

disabilities.

Other provisions of HAVA are likewise designed to promote access for people with disabilities. One of the areas in which HAVA calls for periodic studies is accessible voting for people with disabilities, including those who are blind or visually impaired.²⁰⁶ HAVA specifically directs the EAC and NIST to conduct “human factor research,” on the usability of different types of voting equipment, including how accessibility for individuals with disabilities might be improved.²⁰⁷

Whether or not the failure to allow secret and independent voting by people with disabilities would give rise to liability the ADA, it is clear that it is an important goal. Moreover, under HAVA, all jurisdictions are required to provide technology that allows private and independent voting for people with disabilities by 2006. Accordingly, disability access is among the equality norms that must be taken into consideration, in evaluating different voting technologies.

3. *Multi-Language Access*

The third equality norm is accessibility of voting technology to individuals who are not proficient in English. This norm is embodied in both the Voting Rights Act and the Help America Vote Act. The Voting Rights Act provides:

No voting qualification or prerequisite to voting, or standard, practice, or procedure shall be imposed or applied by any State or political subdivision to deny or abridge the right of any citizen of the United States to vote because he is a member of a language minority group.²⁰⁸

The first provisions protecting language minorities were adopted in 1975. They were extended for ten years in 1982 and for another fifteen years in 1992. In enacting these provisions, Congress found that language minorities had been “effectively excluded from participation in the electoral process” as the result of various practices. Congress also noted the high illiteracy and low voting

---

²⁰⁶42 U.S.C. § 15381.

²⁰⁷42 U.S.C. § 15383.

²⁰⁸42 U.S.C. § 1973b(f)(2).

participation rates among language minorities.²⁰⁹

Under Section 203 of the Voting Rights Act, bilingual voting materials must be provided in any jurisdiction where more than 5% of the voting age population or more than 10,000 citizens of voting age are not English proficient.²¹⁰ Another provision of the VRA, Section 4(f), requires certain jurisdictions to obtain preclearance for any changes affecting voting.²¹¹

HAVA also speaks to language accessibility, requiring that by 2006, voting systems “provide alternative language accessibility” pursuant to the requirements of Section 203. While HAVA’s formal requirements for language access do not extend beyond those set forth in the VRA, the new law clarifies Congress’ intent that these requirements apply to voting technology. In addition, HAVA requires the EAC to study means of improving access for voters with limited English proficiency.²¹² As with the federal disability access requirements, the VRA and HAVA’s provisions regarding access for non-English proficient voters should be viewed as a floor and not a ceiling. They prescribe the minimum for what states and counties must do to protect the voting rights of non-English speaking voters, but not the maximum for what they can do.

4. *Inter-Jurisdictional Equality*

The fourth voting rights norm is the most difficult to define. The Supreme Court has long held that the right to vote is a “fundamental political right” because it is preservative of all other rights.²¹³ For this reason, it has closely scrutinized practices which deny or dilute the right to vote, especially when they disadvantage an identifiable group of voters based upon wealth or place of residence. The difficult question is how the Equal Protection Clause applies –

---

²⁰⁹42 U.S.C. § 1973aa-1a.

²¹⁰42 U.S.C. § 1973aa-1a. For implementing regulations describing in greater detail the criteria for coverage, see 28 C.F.R. § 55.6. For a list of jurisdictions covered under this provision, see 67 Federal Register 48871-77 (July 26, 2002).

²¹¹42 U.S.C. § 1973b(f)(4). This requirement applies to jurisdictions in which over 5% of voting-age citizens were language minorities, but in which materials were not provided in that language and in which fewer than 50% of eligible citizens were registered as of 1972. 28 C.F.R. § 55.5; *see also* 28 C.F.R. Pt. 55, App. (listing jurisdictions covered by Section 4(f)(4) of the Voting Rights Act).

²¹²42 U.S.C. § 15381.

²¹³*Yick Wo v. Hopkins*, 118 U.S. 356 (1886).

or whether it applies at all – in the context of intra-state disparities in voting technology. This might be thought of as the wild card in the deck of equality norms.

The logical starting point in assessing the Fourteenth Amendment's applicability to voting technology is the opinion *Bush v. Gore*. A great deal has been written about the Court's opinion in *Bush v. Gore*, much of it highly critical.²¹⁴ It is not the purpose of this article to join the heated debate over whether the Court decided the case properly (or should have decided it in the first place). Instead, the purpose here is to assess the applicability of the principle underlying *Bush v. Gore*, and the precedent it cites, to the debate over voting technology.²¹⁵

The Court in *Bush* did not, of course, hold that the use of any particular type of voting technology violated the Constitution. Instead, it stated (or more properly, restated) the basic principle of equality in the voting process. In particular, the Court affirmed the principle that: "When the state legislature vests the right to vote for President in its people, the right to vote as the legislature has prescribed is fundamental; and one source of its fundamental nature lies in the equal weight accorded to each vote and the equal dignity owed to each voter."²¹⁶ As I have elsewhere noted, *Bush v. Gore* is an unconventional equal protection case, insofar as it finds a violation in the absence of any evidence that a definable class of voters had been treated unfairly.²¹⁷ But the basic principle on which *Bush v. Gore* rests – namely, equal weight to each vote and equal dignity to each voter – is hardly novel.

What is novel about *Bush* is its application of this principle. The Court concluded that Florida's manual recount, conducted without clear standards dictating which votes should count, violated equal protection. A careful reading of the Court's opinion reveals five specific problems:

1) from one county to another, different standards for determining which votes should count were being applied;

---

²¹⁴For examples of criticism of *Bush v. Gore*, see ALAN M. DERSHOWITZ, SUPREME INJUSTICE: HOW THE HIGH COURT HIJACKED ELECTION 2000 (2001); Laurence H. Tribe, *eroG v. hsuB and its Disguises: Freeing Bush v. Gore from its Hall of Mirrors*, 115 HARV. L. REV. 170, 179 (2001); Jack M. Balkin, *Bush v. Gore and the Boundary Between Law and Politics*, 110 YALE L.J. 1407, 1408 (2001).

²¹⁵For an analysis of this question, see generally Mulroy, *supra* note 94.

²¹⁶531 U.S. at 104.

²¹⁷Tokaji, *First Amendment Equal Protection*, *supra* note 11, at 2489.

2) even *within* certain counties (the opinion specifically mentions Miami-Dade and Palm Beach), inconsistent standards were being applied;

3) in some but not all counties, the recounts included undervotes but not overvotes;

4) there was no assurance that the recounts included in the final tally would be complete; and

5) the Florida Supreme Court's manual recount order did not specify *who* would recount the ballots.²¹⁸

According to the Court, what was lacking were “specific rules designed to ensure uniform treatment of voters.”²¹⁹ The Court's ultimate conclusion was that the manual recount process did not provide “sufficient guarantees of equal treatment” to satisfy the Fourteenth Amendment.²²⁰

To be sure, the Court was careful to limit the scope of its holding, emphasizing that the “problem of equal protection in election processes generally presents many complexities.” In particular, the Court noted that the issue before it was not whether “local entities, in the exercise of their expertise, may develop different systems for implementing elections.”²²¹

It would be a mistake, however, to take from *Bush v. Gore* the lesson that substantial differences in the accuracy of different voting equipment are immune from equal protection scrutiny.²²² The Court did not, after all, say that such differences raise no constitutional problem. Instead, the Court quite accurately noted that the constitutionality of such differences was not the issue before it.²²³ What the Court said, in other words, is not that the use of different voting systems in different counties comports with the Fourteenth Amendment. Instead, it articulated a broad principle – equal

---

²¹⁸*Id.* at 105-08.

²¹⁹*Id.* at 106.

²²⁰*Id.* at 107.

²²¹*Id.* at 109.

²²²See Vikram David Amar, *Adventures in Direct Democracy: The Top Ten Constitutional Lessons from the California Recall Experience*, 92 Calif. L. Rev. 927 (2004).

²²³See Richard Hasen, *The California Recall Punch Card Litigation: Why Bush v. Gore Does Not “Suck”* (forthcoming).

treatment in the voting process – leaving it to future courts to determine the applicability of this principle to such issues as discrepancies in voting technology.

Whatever one might think of the outcome of *Bush*, the principle of voting equality upon which it relies is beyond dispute. But what does this equality principle demand, when it comes to voting technology? For guidance on this question, it is instructive to turn to the four (and there are only four) equal protection cases that *Bush v. Gore* cites.

One of those cases addresses a wealth-based classification, while the others are “one person, one vote” cases involving electoral jurisdictions of substantially different sizes. The first case cited in *Bush v. Gore* is *Harper v. Virginia State Board of Elections*, in which the Supreme Court struck down a state’s poll tax on the ground that it contravened the right to political equality: “Wealth, like race, creed, or color, is not germane to one’s ability to participate intelligently in the electoral process.”²²⁴

In the three other cases, the Court struck down apportionment schemes that accorded different weight to voters in different jurisdictions. For example, in *Gray v. Sanders*, the Court invalidated a system of vote-counting that gave rural counties’ votes greater weight than urban counties votes.²²⁵ Likewise, in *Reynolds v. Sims*, the Court invalidated a legislative apportionment that overweighted the votes of those in smaller districts.²²⁶ This line of cases established the rule that citizens’ votes should not be given significantly less weight due to the happenstance of where they reside. As the Court put it in *Reynolds*, “[d]iluting the weight of votes because of place of residence impairs basic constitutional rights under the Fourteenth Amendment.”²²⁷

In all of these cases, the Court focused on the disparate treatment accorded to different *groups* of voters. In *Harper*, that group was defined by poverty, including those too poor to afford the poll tax. In the one person, one vote line of cases, the affected group was defined by geography, including those who resided in larger districts. In both sets of cases, “an identifiable group of voters” was

---

²²⁴663 U.S. 663 (1966).

²²⁵372 U.S. 368 (1963).

²²⁶377 U.S. 533, 568 (1964); *see also Moore v. Ogilvie*, 394 U.S. 814, 819 (1969) (“the idea that one group can be granted greater voting strength than another is hostile to the one man, one vote basis of our representative government.”).

²²⁷377 U.S. at 566.

accorded less favorable treatment.²²⁸ Moreover, each of these cases occurred against a backdrop of racial inequality.²²⁹

The *Bush v. Gore* equal protection holding goes beyond this precedent in two significant respects. First, the Court holds there to be an equal protection violation without evidence that an identifiable group of voters had been accorded less favorable treatment than another.²³⁰ In contrast to *Harper*, there was no evidence that people of lesser means had been denied the right to vote; and in contrast to *Reynolds*, there was no evidence that the votes of those in urban counties had been diluted.²³¹ What the *Bush* Court instead found problematic was the broad discretion afforded public officials to determine whose vote would count. As I have previously argued, this aspect of the Court's reasoning borrows from First Amendment jurisprudence, which looks with disfavor upon licensing schemes that afford public officials broad discretion to regulate speech.²³²

The second respect in which *Bush v. Gore* expands upon precedent is in applying the one person, one vote rule to the “nuts-and-bolts” of elections.²³³ While prior cases had focused on such “big picture” issues as how districts were drawn, *Bush v. Gore* identifies the procedures and mechanisms used to conduct elections – and more specifically the vote-counting process – as the proper subject of an equal protection challenge.²³⁴ The opinion in *Bush v. Gore* reserves the issue whether discrepancies in voting equipment violate equal protection. But as some commentators have observed

---

²²⁸Tokaji, *First Amendment Equal Protection*, *supra* note 11, at 2489; *see also* Frank I. Michelman, *Suspicion, or the New Prince*, 68 U. CHI L. REV. 679, 684 (2001); Laurence Tribe, *eroG v. hsuB and Its Disguises: Freeing Bush v. Gore from Its Hall of Mirrors*, 115 HARV. L. REV. 170, 225 (2001)

²²⁹*Id.* at 2483-84.

²³⁰Tokaji, *First Amendment Equal Protection*, *supra* note 11, at 2489.

²³¹Nor was there any suggestion that the recount was denying a particular racial group equal treatment. If anything, the decision to stop the manual recounts may have resulted in the disproportionate failure to count the votes of African Americans, who tend to cast invalid votes at higher rates than whites. *See* Tomz & Van Houweling, *supra* note 14.

²³²Tokaji, *First Amendment Equal Protection*, *supra* note 11, at 2490. *See also* Greene, *Is There a First Amendment Defense for Bush v. Gore?*, *supra* note 11 (forthcoming).

²³³Hasen, *supra* note 93, at 378.

²³⁴*Id.*

that its equal protection logic leads to that conclusion.²³⁵ For if discrepancies in the manual recount process may violate equal protection, it is difficult to see why other differences in the “nuts and bolts” of elections may not.

To the extent that the Equal Protection Clause applies to the machinery used to cast and count votes, inter-county disparities in voting equipment raise a serious problem. As noted above, voters and civil rights advocates in at least five states have brought lawsuits, challenging discrepancies in the voting equipment used within those states.²³⁶ In two of those cases, *Black v. McGuffage* and *Common Cause v. Jones*, the courts have found the equal protection allegations sufficient to survive a motion to dismiss.²³⁷

The equal protection argument made in the ACLU’s voting machine cases is actually *less novel* than those at issue in *Bush v. Gore*. These cases require that courts deem the Equal Protection Clause applicable to the nuts and bolts of elections – a proposition that seems hard to dispute after *Bush*. But in contrast to *Bush*, the ACLU cases do not demand that courts deem *discretion* over elections to be constitutionally problematic in itself. Rather, as in cases challenging malapportioned districts, the plaintiffs have produced statistical evidence that some voters are treated less favorably than others based upon their place of residence.

The equal protection argument against unreliable voting equipment is thus more similar to “one person, one vote” cases than is *Bush* itself. It would surely contravene equal protection for the state to discard half the votes in one county, while counting all of those in a neighboring county.²³⁸ The only real question is the *degree* of inequality that is constitutionally tolerable.

Even if one disputes the conclusion that the use of unreliable voting equipment violates equal protection, it can scarcely be contested that there is a constitutional norm against differential treatment of voters within a state, based upon their place of residence.

---

²³⁵Hasen, *supra* note 93; Jack M. Balkin, *Bush v. Gore and the Boundary Between Law and Politics*, 110 YALE L.J. 1407, 1428 (2002)(asserting that “technological differences among counties” are “probably the greatest source of unequal treatment, particularly between more affluent counties and less affluent ones.”).

²³⁶ *Black v. McGuffage* (N.D. Ill. Case No. 01-C-208); *NAACP v. Harris* (S.D. Fl. Case No. 01-CIV-120); *Common Cause v. Jones* (C.D. Cal. Case No. 01-3470); *Andrews v. Cox* (N.D. Ga. Case No. 01-CV-0318); *Stewart v. Blackwell* (N.D. Ohio Case No. 5:02-CV-2028).

²³⁷*Black v. McGuffage*, 209 F. Supp. 2d 889 (N.D. Ill. 2002); *Common Cause v. Jones*, 213 F. Supp. 2d 1106 (C.D. Cal. 2001).

²³⁸*See* Tribe, *supra* note 228.

Accordingly, I define the fourth equality norm that should guide our consideration of voting equipment as inter-jurisdictional equality. My point is not that other inequalities – such as racial disparities or the denial of access to people with disabilities – fall outside the scope of the Equal Protection Clause. Nor is it to deny that *Bush* should be interpreted to reach other areas, in which excessive discretion over the administration of elections is vested in state and local officials.²³⁹ But whatever else the “one person, one vote” line of cases may stand for, they clearly stand for the idea that there are limits upon the state’s ability to accord differential treatment to its voters based on the county or jurisdiction where they reside.

B. Empirical Research on Electronic Voting

With these equality norms in mind, I now turn to an assessment of how existing voting technologies measure up. In the ongoing debate over electronic voting, surprisingly little attention has been given to the important work that social scientists have conducted in the area of voting technology since 2000.²⁴⁰ Yet this research provides considerable guidance in assessing the degree to which different types of voting technology advance the equality norms set forth above. On the whole, it shows that the present generation of electronic voting equipment can considerably reduce the number of uncounted votes. In addition, there is strong evidence that electronic voting can reduce the “racial gap” in uncounted votes, thereby avoiding the disproportionate loss of votes among people of color that tends to result from at least some types of paper-based equipment.

1. *Technology and Uncounted Votes*

a. Measuring Performance

The measure that empirical researchers have typically used to measure voting equipment performance is “residual votes.” This term refers to the sum of undervotes and overvotes. This measurement is not without its limitations. Some voters in every election, of course, *intentionally* choose not to vote. For presidential elections, however,

---

²³⁹See generally Tokaji, *First Amendment Equal Protection*, *supra* note 3; Greene, *supra* note 3.

²⁴⁰The major exception is Prof. Schwartz’s article *Voting Technology and Democracy*, *supra* note 18. There has, however, been substantial empirical research conducted since then, as described below, which sheds significant light on the performance of electronic voting technology in particular.

this number tends to be very small. Stephen Knack and Martha Kropf have estimated the level of residual voting in U.S. presidential contests at between 0.23% and 0.75%, based on survey data from 1980 through 2000.²⁴¹ Knack and Kropf found little variation in intentional undervoting in the presidential race based on race, ethnicity, and party affiliation. They did find that older and poorer voters are somewhat more likely to skip the presidential contest, but even for these voters the intentional undervoting rate was 1.5% or less.²⁴²

Three national studies have undertaken evaluation of the performance of different types of voting technology. Dr. Henry Brady and his colleagues at the U.C. Berkeley Survey Research Center examined the residual vote rates arising from the use of different types of voting systems, in California and throughout the country.²⁴³ The Berkeley study analyzed data from 2,219 U.S. counties in the 2000 general election.²⁴⁴ Brady and his colleagues found that DRE machines, lever machines, optical scan ballots, and paper ballots all produce significantly fewer residual votes than punch cards. Punch cards had a residual vote rate of 2.64%, compared to

---

²⁴¹Stephen Knack & Martha Kropf, *Roll-Off at the Top of the Ballot: Intentional Undervoting in American Presidential Elections*, Politics & Pol'y (December 2003), at 14 (manuscript).

²⁴²*Id.* While intentional undervotes for president are uncommon, it is more difficult to estimate how many voters intentionally skip down-ballot races. COUNTING ALL THE VOTES, *supra* note 20, at 9. Even for senatorial and gubernatorial races (in which voters are choosing among the same candidates statewide), it is difficult to say with confidence how many voters are intentionally undervoting, since there has to date been no systematic study of these races similar to that which Knack and Kropf conducted for the presidential contest. For races further down-ballot – such as U.S. House, state legislative, and local races – the reliability of residual votes is much more problematic, because different voters are voting for different candidates in different parts of each state. Accordingly, the rate of unintentional undervoting (and therefore the overall residual vote rate) may vary dramatically for reasons having nothing to do with the equipment used. It is for this reason that empirical researchers studying the performance of voting equipment have focused on presidential residual votes and, to a lesser extent, gubernatorial and senatorial undervotes. For presidential undervotes, the incidence of intentional undervoting is small and does not vary significantly based on the voter's race, ethnicity, or party affiliation. While the precise level of intentional undervoting has not been studied for gubernatorial and senatorial races, voters are at least choosing between the same candidates in different parts of the state – thereby eliminating the possibility that variations in residual vote rates result from differences in the competitiveness of the race, rather than voting equipment used.

²⁴³COUNTING ALL THE VOTES, *supra* note 20.

²⁴⁴COUNTING ALL THE VOTES, *supra* note 20, at 1. This study did not look at previous year's elections, because that data could not thoroughly be audited. *Id.*

1.68% for DREs and 1.37% for optical scan ballots.²⁴⁵

The intrastate disparities resulting from the inequalities in voting technology are dramatic. For example, the residual vote rate in Los Angeles County, one of the most racially and ethnically diverse counties in the country, was 2.7% in the 2000 presidential election. By contrast, neighboring Riverside County – which used second-generation DREs of the touchscreen variety in the 2000 election – had a residual vote rate of 0.69%.²⁴⁶

In a further effort to test whether the equipment was really responsible for the discrepancies in residual votes, Dr. Brady and his colleagues have also examined what happens when counties move from one type of equipment to another. Focusing on three California counties that moved from Votomatic-style punch cards to precinct-count optical scan equipment between 1996 and 2000, Dr. Brady found significant reductions in the residual vote rate within each²⁴⁷ He also found that a California county shifting from central-count optical scan ballots to a touchscreen DRE equipment reduced its residual vote rate by more than half (from 1.21% to 0.59%).²⁴⁸

The differences in the 2003 California recall election reveal an even more striking discrepancy between punch cards and other voting systems. On the first ballot question, whether to recall Governor Gray Davis, Dr. Brady found that punch cards had a residual vote rate of 6.3%, compared to 2.7% for optical scans and 1.5% for electronic voting equipment.²⁴⁹ Of the twenty largest counties in the State of California, *all five* remaining punch card

---

²⁴⁵For the five general categories of voting equipment, the average residual vote rates were as follows:

Punch cards	2.64%
DREs	1.68
Optical scan	1.37
Lever	1.72
Paper ballots	1.99

Id. at 29. As was the case with the Caltech/MIT study, the dataset used by Brady and his associates did not allow first- and second-generation DRE's results to be disaggregated.

²⁴⁶Materials from Assembly Committee on Elections, Reapportionment and Constitutional Amendments Hearing, Jan. 16, 2001.

²⁴⁷Initial Declaration of Henry E. Brady for *SVREP v. Shelley*, Aug. 11, 2003, available at http://ucdata.berkeley.edu/new_web/recall.html. In Fresno County, for example, the average residual vote rate declined from 3.35% to 0.70% after moving from punch cards to precinct-count optical scan ballots. Dr. Brady found similar results for two other counties that moved from punch cards to precinct-count optical scan systems (Marin and San Francisco).

²⁴⁸COUNTING ALL THE VOTES, *supra* note 20, at 44..

²⁴⁹California does not use lever machines.

counties had residual vote rates higher than all other counties. Comparing these residual vote rates to exit polling data, Dr. Brady estimated that between 160,000 and 174,000 votes were lost due to the continued use of punch card voting machines. Counties that converted from punch cards to DREs or precinct-count optical scans saw a dramatic drop in their residual vote rates. For example, racially diverse Alameda County – which, when it used punch card machines, had one of the higher residual vote rates in the state – had one of the lowest residual vote rates (0.74%) when it switched to DREs for the 2003 recall election.²⁵⁰

The General Accounting Office also produced a report of the residual vote rates of different types of voting equipment in 2001, which yielded results similar to those found by the Berkeley group. The study concluded that the “type of voting equipment that counties used in the 2000 general election . . . had an effect on uncounted presidential votes.”²⁵¹ Like the Berkeley study, the GAO concluded that higher levels of residual voting tended to occur in counties using punch card equipment. Paper ballots, lever machines, optical scan ballots and DRE machines all had roughly similar levels of residual voting.²⁵² Overall, there were “no significant differences” among these types of equipment.²⁵³ It did, however, find that precinct-count optical scan equipment yielded better results than those counties that did not have technology allowing for feedback to voters and the opportunity to correct errors.²⁵⁴

One report found somewhat different results than the Berkeley and GAO studies, particularly with respect to electronic voting. In its study of elections between 1980 and 2000, the Caltech/MIT Voting Technology Project found that the

---

²⁵⁰Another study of the California recall election found evidence that many voters had mistakenly cast votes for the wrong candidate in that election. Michael Dee of Swarthmore found an unusually large number of votes cast for candidates whose names appeared adjacent to the two major candidates (Schwarzenegger and Bustamante), among voters using punch cards. He concluded, based on this evidence, that punch cards increase the rate of voter errors by at least a third. Michael Dee, *Do Punch Cards Promote Voter Errors? Evidence from the California Recall Election* (May 2004), available at <http://www.swarthmore.edu/socsci/tdee1/Research/bookends0404.pdf>.

²⁵¹GENERAL ACCOUNTING OFFICE, ELECTIONS: STATISTICAL ANALYSIS OF FACTORS THAT AFFECTED UNCOUNTED VOTES IN THE 2000 PRESIDENTIAL ELECTION 3 (Oct. 2001).

²⁵²*Id.* at 8.

²⁵³*Id.* at 9.

²⁵⁴*Id.* This is consistent with the results from Florida, reported in Prof. Schwartz’s article. Schwartz, *supra* note 95, at 631-40.

residual vote rate for DREs was almost as high as that for punch cards during that period.²⁵⁵ Citing the Caltech/MIT findings, Prof. Schwartz concluded that “the verdict on DRE voting technologies must be negative.”²⁵⁶ The Caltech/MIT report, however, expressly rejected the conclusion that DRE technology is “inherently flawed and should not be used.”²⁵⁷ It suggested that the high residual vote rate with DREs may have resulted from the poor user interface with some types of DREs, particularly the earlier “push button” model.²⁵⁸ In fact, the report noted that, even in 2000, two-thirds of DRE counties were still using first-generation DRE equipment.²⁵⁹

---

²⁵⁵See VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 21. The Caltech/MIT report found the following residual vote rates in the presidential contests between 1980 and 2000, from highest to lowest:

Punch Card	2.5%
DRE	2.3
Paper Ballot	1.8
Optical Scan	1.5
Lever Machine	1.5

Id.; see also Stephen Ansolabehere, *Voting Machines, Race, and Equal Protection*, 1 ELECTION L.J. 61, 63 (2002).

²⁵⁶Schwartz, *supra* note 95, at 694. In reaching this conclusion, Prof. Schwartz also cited the questions of reliability and the administrative issues raised by DREs, which are discussed at greater length below.

²⁵⁷VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 23.

²⁵⁸*Id.*

²⁵⁹*Id.* at 19-20. A prior report of the VTP supports the conclusion that the relatively high rate of residual voting with DREs used from 1980 to 2000 are largely due to the first-generation DREs that were predominantly used in pre-2000 elections. According to a March 2001 report, the residual vote percentages with the four most common systems in 2000 were:

Punch card	
Votomatic	3.0%
Datavote	1.0
Optical Scan	1.2
Lever	1.7
DRE	1.6
Paper	1.3

These results are in line with those found by the Berkeley and GAO studies, and support the conclusion that the first-generation DREs are largely responsible for the relatively high level of residual voting with this technology, when elections from 1980 through 2000 are aggregated. See Caltech/MIT Voting Technology Project, *Residual Votes Attributable to Technology*, available at http://www.hss.caltech.edu/~voting/CalTech_MIT_Report_Version2.pdf, Mar. 30, 2001, at 11. Similar results are reported in a more recent study co-authored by Michael Alvarez, one of the Caltech/MIT VTP’s principal co-authors. Alvarez, et al., *supra* note 18, at 40-41. Examining both national and California data, Alvarez and his co-authors found that

b. First- and Second-Generation DREs

Until recently, there was no empirical research disaggregating first- and second-generation DREs. The Berkeley, the Caltech/MIT, and the GAO report each group DREs together, presumably because it could not easily be determined from the data before them whether jurisdictions were using first- or second-generation equipment. Nor did these studies have available to them nationwide data allowing them to ascertain the impact of precinct-count optical scan equipment, which provides feedback and the opportunity to correct errors, as opposed

The only available nationwide study to disaggregate different types of DREs and optical scans is by Prof. David Kimball, who examined data from 2002 gubernatorial elections.²⁶⁰ Prof. Kimball's study examined 1846 counties, of the a total of 2184 that cast votes for governor in 2002. The residual votes, by type of equipment, were as follows:

Votomatic Punch Card	3.5%
Datavote Punch Card	2.8
Paper Ballot	2.3
Lever Machine	2.2
Older DRE (full-face)	2.2
Central-Count Optical Scan	2.0
Precinct-Count Optical Scan	1.3
Newer DRE (touchscreen)	1.2 ²⁶¹

Prof. Kimball also conducted a multivariate analysis, to control for the impact of other state election features that may affect unrecorded votes. These included the race, ethnicity, age, education levels, and income levels of voters, and whether the states in question allow a straight-party voting option and write-in voting. And importantly, Prof. Kimball also controlled for the level of competition in each state's races.²⁶²

After controlling for all these variables, Prof. Kimball found that voting technology had a substantial effect on residual voting. As

---

punch cards performed the worst, while optical scan and touchscreen equipment had much lower levels of residual votes.

²⁶⁰See Kimball, *supra* note 19.

²⁶¹Kimball, *supra* note 19, at 28, Table 2. I have omitted the results for "mixed" counties – that is, counties in which more than one type of equipment is used.

²⁶²*Id.* at 13-14.

in other studies, Votomatic-style punch card voting equipment performed worst, increasing residual votes by 58% in comparison with central-count optical scan ballots. The best-performing equipment, according to Prof. Kimball's study, were second-generation DREs, which reduced residual votes by 41% in comparison to central-count optical scans.²⁶³ By contrast, first-generation DREs performed *worse* than other voting equipment – including both central-count optical scans and lever machines. The only type of equipment that fared worse than first-generation DREs was the Votomatic-style punch card.²⁶⁴

Prof. Kimball also examined changes in residual vote rates, among those counties that changed voting equipment between 2000 and 2002. Unsurprisingly, he found that counties that abandoned their punch card equipment experienced dramatic reductions in their residual vote rates.²⁶⁵ Counties that moved to precinct-count optical scan or second-generation DRE equipment saw significant reductions in their residual vote rates. By contrast, those that moved from paper ballots, lever machines, or Datavote punch cards to either central-count optical scans or first-generation DREs actually experienced a slight *increase* in residual votes.²⁶⁶

Prof. Kimball's analysis thus demonstrates the necessity of disaggregating different kinds of equipment *within* the five general categories that I have identified. Conducting further analyses of this nature, in the 2000 election and beyond, is imperative in order to ascertain just how well each type of equipment performs. But the available evidence indicates that second-generation DREs fare best, followed by precinct-count optical scans.

2. *Race and Voting Technology*

Empirical research conducted since the 2000 election has also examined the *racial* implications of the use of different voting technologies.²⁶⁷ There are at least two possible ways in which voting

---

²⁶³*Id.* at 17-18.

²⁶⁴*Id.* at 18.

²⁶⁵*Id.* at 21.

²⁶⁶*Id.*

²⁶⁷Tomz & Van Houweling, *supra* note 14 ; *see also* Schwartz, *supra* note 18, at 641; Ford Fessenden, *Ballots Cast by Blacks and Older Voters Were Tossed in Far Greater Numbers*, N.Y. TIMES, Nov. 12, 2001 (reporting a 10% ballot spoilage rate in predominantly African American precincts, compared to 2.9% overall)

technology might interact with race.²⁶⁸ The first is that voters of certain racial or ethnic backgrounds may be more likely to reside in counties using that equipment. Put another way, inferior voting technology may be disproportionately concentrated in counties with larger numbers of minorities. The second possibility is that the use of certain types of voting equipment, such as the punch card, may have a more severe impact on some voters than others. For example, to the extent that people with lower educational or income levels have more difficulty using a certain type of equipment, it may result in a “racial gap” in uncounted votes. I refer to the first issue as the *usage* of voting equipment, and the second as the *impact* of voting equipment. Both must be examined, in order to assess whether use of different voting technologies results in the disproportionate loss of votes among people of different races or ethnicities.

a. The Usage of Voting Technology

On the first question, the available evidence paints a more complicated picture than has often been supposed. It is not, as some commentators have asserted,²⁶⁹ unambiguously true that racial minorities are more likely to use unreliable voting equipment than are white voters. In his analysis of the 2000 Florida election, Allan Lichtman found that African Americans were somewhat more likely than whites to reside in counties using inferior voting technologies.²⁷⁰ This is not, however, the case within all states.

Nationwide, blacks and whites are almost equally likely to use punch card ballots. Relying on 1998 data, Knack and Kropf found that 31.9% of whites and 31.4% of blacks lived in counties using punch card equipment.²⁷¹ Latinos were more likely to reside in punch card counties, with 44.3% doing so in 1998. However, they found that this difference was “entirely attributable” to Los Angeles County (home to almost one seventh of the nation’s Latino voters),²⁷² which eliminated its punch cards effective March 2004. Blacks were

---

²⁶⁸See Ansolabehere, *supra* note 255, at 64-67.

²⁶⁹*Toward Chad-Free Elections*, N.Y. TIMES, Mar. 6, 2001; William Raspberry, *Post-Traumatic Suggestions*, WASH. POST, Jan. 1, 2001; E.J. Dionne, *Back to Florida*, WASH. POST, Dec. 5, 2000.

²⁷⁰Lichtman, *supra* note 83, at 4 (finding that 70% of blacks used punch card and central-count optical scan technologies, as opposed to 64% of non-blacks).

²⁷¹Stephen Knack & Martha Kropf, *Who Uses Inferior Voting Technology?*, 35 PS: POL. SCI & POLITICS 541 (2002).

²⁷²*Id.* at 544.

somewhat more likely than whites to use electronic voting equipment, who were in turn more likely than Latinos to vote electronically.²⁷³ Therefore, on a national basis, the racial differences in the usage of punch card and electronic voting equipment are fairly small.²⁷⁴

For the purpose of determining whether the usage of different voting technologies has a racial impact, however, the critical question is not whether there are *nationwide* differences in the usage of different technologies across states. That is because elections, for President as well as lower offices, are conducted within states rather than across states. In the presidential race, the electoral college system accords a fixed number of votes to each state, which does not depend on how many valid votes are cast. As Knack and Kropf put it, “differences in voting technology that are purely cross-state cannot disadvantage a state’s voters relative to other states.”²⁷⁵ What can disadvantage voters are *intra-state* differences in the equipment used. The critical question, then, is whether there are significant racial differences in the usage of punch cards *within* particular states, rather than *across* the several states.²⁷⁶

---

²⁷³*Id.*

²⁷⁴For a similar conclusion, see GAO, *supra* note 251, at 12 (finding that “minorities and persons with lower income were not more likely than others to reside in counties that used punch cards). Another analysis found some racial differences in the usage of voting technology. Ansolabehere, *supra* note 255, at 64-68. Prof. Ansolabehere found “no apparent tendency for *counties* with larger minority populations to be less likely to use the latest technology [DREs].” *Id.* at 66 (emphasis added). But he did find that minority voters were more likely to use punch cards than white voters. Because counties differ dramatically in population size, “the likelihood that a county uses a technology may not mirror the likelihood that a voter uses a technology.” *Id.* at 66. Ansolabehere found that 36% of white voters used punch cards, while 44% of non-white voters used them. *Id.* at 67. Overall, non-white voters were 20% more likely to reside in counties using punch cards. *Id.*

²⁷⁵See Knack & Kropf, *supra* note 271, at 545.

²⁷⁶Prof. Ansolabehere contends that the evidence regarding punch card usage runs contrary to the equal protection arguments made against this type of equipment. Ansolabehere, *supra* note 255, at 64-69. He asserts, for example, that the lower usage of punch cards in counties with higher minority populations tends to “run contrary to the premises” of the California litigation which challenged the use of punch cards as violative of the Fourteenth Amendment and the Voting Rights Act. *Id.* at 65 (citing *Common Cause v. Jones*). But Prof. Ansolabehere’s argument misunderstands the legal challenge to punch cards, made in *Common Cause* and the other ACLU cases, in three important respects.

First, Prof. Ansolabehere’s argument confuses the two distinct claims that voting rights advocates have made against the use of punch cards. The equal protection claim made in *Common Cause* and the other ACLU punch card cases does *not* depend upon the existence of racial discrimination. Instead, this claim

On this point, the evidence shows that voters of color are more likely to use inferior voting equipment in some but not all of the states. Overall, Knack and Kropf found that there were 29 states in which different types of voting equipment, including punch cards, were used within the state. In 11 of those states, blacks were more likely than whites to live in punch card counties; and in eight of those states, Latinos were more likely than whites to live in punch card counties.²⁷⁷

In some states, the usage of voting equipment shows little variation across racial and ethnic groups. For example, in Ohio, 74.5% of whites used punch cards, compared to 73.8% of blacks and 71.2% of Latinos. But in others, the intra-state racial disparities in equipment usage were pronounced. For example, in California (one of the states in which race discrimination claims under Section 2 of the Voting Rights Act were brought), 80.8% of African American voters used punch cards, compared to 58.3% of whites and 66.6% of Latinos.²⁷⁸ In sum, the evidence shows that there are some intra-state racial disparities in the usage of voting equipment, though they are far

---

rests on the *inter-county* disparities, arising from the use of punch cards in some counties but not others. The other claim in these cases is that the use of punch cards results in the disproportionate denial of minority votes, on account of race, in violation of Section 2 of the Voting Rights Act. This claim, but not the equal protection claim, depends on showing that the use of punch cards has a disparate impact on voters of color.

Second, Prof. Ansolebehere's argument misses the fact that the Section 2 claims in *Common Cause* and other punch card cases are based on practices *resulting in* racial disparities, not intentional discrimination. Contrary to Prof. Ansolebehere's apparent assumption, "discriminatory intent" is not required to make out a claim under Section 2. *Id.* at 69. The cases challenging punch cards did not depend upon the existence of such intent, but on practices that result in the denial of minority votes. Accordingly, Prof. Ansolebehere's argument that there is no evidence of discriminatory intent is directed at a strawman.

Third, *Common Cause* and the other cases asserting claims under Section 2 relied solely on *intra-state* disparities in the usage of punch card voting equipment. In particular, plaintiffs in those cases allege that the use of punch cards results in the disproportionate loss of minority votes. The fact that punch cards are not more heavily used by heavily minority counties *nationwide* is therefore irrelevant to the race discrimination claims made in those cases. What is significant is (1) whether racial minorities within a particular state are more likely to use inferior technology, and (2) whether within counties that use inferior technology, racial minorities are disproportionately harmed.

²⁷⁷Knack & Kropf, *supra* note 271, at 545.

²⁷⁸Although the state-by-state usage of voting equipment is not set forth in the final version of Knack & Kropf's analysis, they are available in an earlier version. Stephen Knack & Martha Kropf, *Who Uses Inferior Voting Technology*, Tab. 5, at 28 (Jan. 2001), available at <http://unofficial.umkc.edu/kropfm/inferior.pdf>.

from uniform nationwide.

b. The Impact of Voting Technology

As noted above, the second way in which voting technology may result in racial disparities is if the same equipment results in more lost votes among some groups than others. On this point, the picture is considerably more clear. The available evidence shows that certain types of voting equipment do generate a significant “racial gap,” resulting in more lost votes among non-white voters than among white voters. The empirical research also shows that some types of voting technology – including DREs and possibly precinct-count optical scans – can reduce, if not entirely eliminate, this racial gap. In short, the evidence shows that, when it comes to racial disparities, the differential *usage* of voting equipment is far less important than the differential *impact* of certain types of voting equipment on people of different races.

As noted above, Allan Lichtman’s study for the U.S. Commission on Civil Rights found an especially strong correlation between race and residual voting in counties using punch card and central-count optical scan technology.²⁷⁹ Subsequent studies have looked beyond Florida, examining nationwide data in an attempt to assess the racial impact of different voting technologies. Sinclair and Alvarez, for example, examined precinct-level data from Los Angeles County, and concluded that Latino, African American, and Asian American voters were all more likely to cast residual votes than white voters.²⁸⁰

Examining data from the 1996 election, Knack and Kropf found that the level of residual voting tended to rise with the percentage of minorities in a county.²⁸¹ However, they also found that the “link between African American population share and voided ballots disappears in counties using types of voting technology that can be programmed to prevent errors” (specifically, DREs and

---

²⁷⁹Lichtman, *supra* note 83, at 4. See also Bruce E. Hanson, *A Precinct-Level Demographic Analysis of Double-Punching in the Palm Beach Presidential Vote* (2000)

²⁸⁰D.E. “Betsy” Sinclair & R. Michael Alvarez, *Who Overvotes, Who Undervotes, Using Punch Cards? Evidence from Los Angeles County*, 57 PoL. RESEARCH. Q., No. 1, at 15 (2004). See also John Mintz & Dan Keating, *A Racial Gap in Voided Votes*, WASH. POST, Dec. 27, 2000, at A1 (reporting that African American precincts in the Chicago area, where punch cards are used, had a high rate of residual voting).

²⁸¹Stephen Knack & Martha Kropf, *Voided Ballots in the 1996 Presidential Election: A County-Level Analysis*, 65 J. OF POLITICS 881 (2003).

precinct-count optical scan equipment).²⁸² Knack and Kropf qualified their analysis, however, to note that because their results were based only on *county-level* data, it could not be inferred that minorities were more likely to have their ballots voided based solely on their results. It is possible, at least in theory, that the relatively high rate of rate of residual voting in counties with large minority populations could be the result of ballots cast by white voters. Put another way, there is a danger in attempting to infer individual behavior from group results – especially when the group results come from large and heterogeneous populations, such as those often found at the county level.²⁸³

Notwithstanding the limitations of county-level data, other social scientists have also attempted to use it in order to estimate the degree to which voting technologies have a differential racial impact. Profs. David Kimball, Chris Owens and Katherine Keeney examined unrecorded votes cast in 2895 counties in 2000, and found results similar to Knack and Kropf's.²⁸⁴ In particular, they found that DREs, precinct-count optical scan, and lever machines reduced the racial gap – as compared to punch cards and central-count optical scans.²⁸⁵

Two other studies examining county-level data have yielded different results. Studies by the General Accounting Office and Prof. Ansolabehere both found that counties with higher percentages of minorities had higher percentages of residual votes.²⁸⁶ The GAO was careful to qualify its results, by noting that it had examined only county-level data,²⁸⁷ which as noted above may obscure the racial impact of voting technology. In addition, both studies attempt to estimate the racial gap in uncounted votes *after* controlling for such factors as education, poverty, and experience voting. But in the real world, there *are* differences among racial groups in terms of these characteristics. Accordingly, controlling for these variables in conducting a racial analysis may actually obscure the differential impact of voting equipment, given the different characteristics that real voters actually have.²⁸⁸

---

²⁸²*Id.* at 882, 892.

²⁸³ Social scientists refer to this problem as the “ecological fallacy.” *Id.* at 894.

²⁸⁴David Kimball, et al., *Unrecorded Votes and Election Reform*, SPECTRUM, Winter 2003, at 34.

²⁸⁵*Id.* at 35.

²⁸⁶GAO, *supra* note 251, at 9-11, 12; Ansolabehere, *supra* note 255, at 64.

²⁸⁷GAO, *supra* note 251, at 12.

²⁸⁸Tomz & Van Houweling, *supra* note 14, at 49.

In an effort to more carefully study the interaction between race and voting technology, other studies have undertaken *precinct-level* analyses. Rather than simply examining whether there is a correlation between minority population and residual vote rates *across counties*, they have examined the correlation *across precincts*, to determine whether residual vote rates tend to increase with the percentage of minorities. The advantage of this approach is that it helps deal with the ecological fallacy. In addition, these studies have presented their results *without* controlling for education, poverty, or voter experience – the advantage of which approach is to show the differential impact that voting equipment actually has in the real world, given the varying degrees to which white and minority voters may have in education, poverty and voting experience.

Michael Tomz and Robert P. Van Houweling have conducted the most thorough precinct-level analysis of voting technology. They examined racial disparities arising from the use of different voting equipment, using precinct-level data from South Carolina and Louisiana. Tomz and Van Houweling found that the incidence of overvotes with both punch card and optical scan equipment increased with the percentage of African Americans.²⁸⁹ That gap disappears almost entirely, however, when non-paper-based systems are used. As Tomz and Van Houweling explain: “the black-white gap in voided ballots was substantially lower with DRE and lever machines than with punch cards and optical scanners.”²⁹⁰ This may be explained by the error-correction protection that DREs have, to prevent accidental overvotes and undervotes. In South Carolina, one of the states examined in their studies, the racial gap with punch card machines was 4.2%, and with optical scans was 6.2%. With DRE systems, by contrast, the racial gap dropped to 0.5%.²⁹¹ Overall, “DRE and lever machines cut the racial gap in uncounted votes *by a factor of ten*.” Tomz and Van Houweling conclude that the small gap that remains with DRE and lever machines (0.3 to 0.7 percent) may result from intentional undervoting (i.e., choosing not to cast a vote for any office), which African Americans tend to do at a slightly higher rate than whites.²⁹² These findings demonstrate that, when it comes to eliminating the racial disparity in uncounted votes, DREs do significantly better than their paper-based counterparts. In fact, DREs “nearly eliminate the difference between black and white [vote]

---

²⁸⁹*Id.* at 47 (citing literature).

²⁹⁰*Id.* at 52.

²⁹¹*Id.* at 54.

²⁹²*Id.* at 58.

invalidation rates.”²⁹³

Other studies examining the racial impact of voting technology are largely consistent with Tomz and Van Houweling’s findings. The studies have found a significant racial gap arising from the use of punch cards and central-count optical scan.²⁹⁴ Research also demonstrates that the racial gap decreases, in counties that move to electronic voting technology.²⁹⁵ Less clear is whether the use of precinct-count optical scan equipment can similarly reduce the racial gap in uncounted votes. Some research tends to show that precinct-count optical scans can reduce the correlation between race and residual votes.²⁹⁶ But Tomz and Van Houweling’s examination of counties in which precinct-count optical scan equipment was used yielded inconsistent results.²⁹⁷

A variety of explanations have been offered for the racial disparity in uncounted votes, including socioeconomic disparities, educational attainment levels, illiteracy rates, and the quality of pollworker assistance.²⁹⁸ Some have suggested that African Americans may be less likely than whites to obtain assistance, especially in jurisdictions where there is a history of voter intimidation or harassment.²⁹⁹ Whatever the explanation, there is no question that there is a racial gap that results from the use of at least some paper-based voting technologies.

Technology is not, of course, the *only* factor that causes higher residual vote rates among voters of color. Nor can technology improvements alone be expected to eliminate the racial gap in

---

²⁹³*Id.* at 59.

²⁹⁴*See, e.g.,* Sinclair & Alvarez, *supra* note 280 (finding large racial gap in residual votes among voters using Votomatic punch cards).

²⁹⁵*See* Kimball, et al., *supra* note 284; COUNTING ALL THE VOTES, *supra* note 20, at 44 (finding decrease in residual vote rate in county that moved from central-count optical scan to touchscreen DRE); Expert Report of Richard Engstrom in *Stewart v. Blackwell* (examining four demographically similar Ohio counties, and finding that the one using DREs had significantly fewer overvotes than the other three, which used punch cards).

²⁹⁶*Id.* at 49 n.2. *See also*, House Minority Report, *supra* note 91, at 8 (reporting that the City of Detroit’s residual vote rate declined significantly when it moved from punch cards to central-count optical scan technology); COUNTING ALL THE VOTES, *supra* note 20, at 44 (finding decrease in residual vote rate in county that moved from punch cards to precinct-count optical scan).

²⁹⁷*Id.* at 56.

²⁹⁸*Id.*

²⁹⁹*Id.*

uncounted votes.³⁰⁰ The available evidence does, however, indicate that conversion to electronic voting can considerably reduce the disparities that arise from the use of some, if not all, paper-based voting equipment.

3. *Implications of the Empirical Research*

The considerable empirical research that has been conducted on voting technology allows the electronic voting debate to be seen in a much different light. While the public debate has largely focused on the security flaws in electronic voting, the empirical research reveals that second-generation DREs offer considerable advantages, when it comes to the equality norms defined above. Prof. Kimball's research reveals that they perform even better than precinct-count optical scans in this respect. Implementation of DRE voting technology thus advances the norm of inter-jurisdictional equality which, as noted above, inheres in the Equal Protection Clause.

That is not to say that the Fourteenth Amendment commands that counties move to the best available voting technology – particularly given the intense disagreement over what the best available technology is and how it should be measured. As set forth above, the Equal Protection Clause is most plausibly understood as mandating inter-jurisdictional equality when it comes to voting equipment. But there is more than one way of achieving this objective. In fact, the statewide implementation of *any* type of voting technology – even the most inaccurate one – would at least in theory ensure inter-jurisdictional equality, since voters in different counties would be treated the same. Thus, a state that used punch cards in some counties but DREs in others could, in theory, cure this inter-jurisdictional inequality in one of two ways: (1) all counties could convert to punch cards, or (2) all counties could convert to DREs. Few would argue, however, that converting to less accurate voting equipment is a sensible way of remedying an existing inter-jurisdictional inequality. Moreover, there can be substantial inter-county disparities even among counties using the same type of unreliable equipment, depending upon the demographic characteristics of those counties. Accordingly, for states that using multiple systems, implementation of DRE voting equipment provides the most plausible means of advancing the norm of inter-jurisdictional equality.

The State of Georgia's experience provides a graphic example of how implementation of DREs can advance this equal protection

---

³⁰⁰See Lichtman, *supra* note 83, at 17.

norm. In the 2000 election, Georgia employed a hodgepodge of voting equipment, including punch card ballots, optical scan ballots, lever machines and hand-counted paper ballots.³⁰¹ Implementation of DREs dramatically reduced the number of uncounted votes³⁰² Statewide, implementation of DRE technology reduced the senatorial residual vote rate from 4.8% to 0.88% percent. Residual vote rates declined dramatically in the rural and urban counties that had experienced the highest rates of over and undervoting in 1998 and 2000. The consequence of Georgia's transition to a uniform DRE system statewide was therefore to reduce the inter-county disparities in uncounted votes.

The empirical research also has obvious implications for the norm of racial equality. The evidence shows that implementation of electronic voting can considerably reduce the gap in uncounted votes that paper-based voting equipment tends to produce. Precinct-level studies leave little doubt that, from the perspective of racial equality, DREs are superior to both punch cards and central-count optical scan systems. Although there is at least some evidence that precinct-count optical scan systems may also reduce the racial gap, the evidence is less clear on this point. Accordingly, the norm of racial equality as well as the norm of inter-jurisdictional equality supports the implementation of electronic voting.

C. Technology and Accessibility

In addition to advancing the goals of racial equality and inter-jurisdictional equality, present-generation DRE technology also offers significant advantages over paper-based voting equipment from the perspective of disability and multilingual access. While there has been relatively little empirical research on the accessibility benefits of different voting technology,³⁰³ DREs provide accessibility features that are not available with other types of equipment.³⁰⁴

From a disability access perspective, contemporary DRE

---

³⁰¹Georgia Secretary of State, *Analysis of Undervote Performance of Georgia's Uniform Electronic Voting System* (January 2003), available at <http://www.sos.state.ga.us/pressrel/undervoteanalysis.htm>.

³⁰²*Id.*; Letter from Rep. Ney to Gov. Dean, July 13, 2004, available at <http://www.house.gov/cha/neyrespo.pdf>.

³⁰³As noted above, HAVA calls for the EAC and NIST to conduct such research.

³⁰⁴Because lever machines are no longer manufactured and paper ballots are ill-suited to all but the smallest counties, I focus on the other three types of machines in the discussion that follows.

voting machines offer significant advantages. Most important among these advantages are that they allow a secret and independent ballot for people with disabilities.³⁰⁵ Until now, many people with disabilities have been forced to rely on friends, relatives, or poll workers to mark their ballots for them. Some of these voters relate stories of those third parties questioning their choices and even attempting to persuade them to change their minds.³⁰⁶ To the extent that casting a secret ballot is considered an integral component of the right to vote, the failure to allow secret voting by people with disabilities raises serious equality concerns.

Disability access to the vote may also affect the results of elections. A nationwide Harris poll conducted in 2000 revealed that people with disabilities were 20 % less likely to vote than able-bodied Americans. The same poll also revealed that people with disabilities favored then-Vice President Gore over then-Gov. Bush by an 18% margin. If the turnout for people with disabilities had been equivalent to that of non-disabled voters, then Al Gore would likely have carried Florida and won the election.³⁰⁷

Electronic voting technology can help accommodate voters with at least four different types of disabilities: (1) visual impairments, (2) cognitive impairments, (3) manual dexterity limitations, and (4) mobility limitations. Several DRE models now on the market have an audio capacity for who are blind or have visual impairments.³⁰⁸ This capacity may also allow independent voting by those with cognitive impairments that prevent them from reading. Some DRE systems also have devices such as a “sip and puff tube” or “jelly switch” that allow people with manual dexterity impairments

---

³⁰⁵See Michael Waterstone, *Civil Rights and the Administration of Elections – Toward Secret Ballots and Polling Place Access*, 8 J. GENDER RACE & JUST. 101, 104 (2004)(arguing that federal voting rights laws should be interpreted to protect the right of disabled citizens to vote “in the same manner as their fellow citizens”).

³⁰⁶*Id.* at 106-08.

³⁰⁷Wisconsin Coalition for Advocacy, *Disability Considerations in the Help America Vote Act* (2004), available at www.nls.org/conf2004/hava.htm. This assumes that Florida’s disabled voters turned out at the same rate as did disabled voters nationally, and that Florida’s disabled voters favored Gore over Bush by the same margin as disabled voters nationally.

³⁰⁸Waterstone, *supra* note 195, at 362; GENERAL ACCOUNTING OFFICE, VOTERS WITH DISABILITIES: ACCESS TO POLLING PLACES AND ALTERNATIVE VOTING METHODS 30 (Oct. 2001); American Association for People with Disabilities, *Voting Technology for People with Disabilities*, (March 2003) available at <http://www.aapd-dc.org/dvpmain/votemachines/downloads/Manhattan%20voters%20experiences.pdf> (describing features of currently available DRE systems).

to cast votes independently.³⁰⁹ They may also be positioned in order to accommodate people with mobility impairments.³¹⁰ Finally, they can be taken outside the polling place for “curbside voting” by those who cannot enter their local polling place, or even to voters’ homes.³¹¹

Paper-based voting systems, by contrast, do not have an audio capacity, thereby preventing people with visual impairments or those who cannot read from voting independently. Both punch card and optical scan systems require that voters be able to hold an object (either a stylus or a pencil) to punch or mark the ballot, preventing people with manual dexterity impairments from voting independently. And paper-based systems may also be more difficult for those with mobility impairments, such as people in wheelchairs, since they require the ability to reach the stylus or pencil and the ballot device.³¹²

HAVA recognizes the superiority of DRE systems when it comes to accommodating people with disabilities. As noted above, the law requires that each jurisdiction provide one DRE unit “or other voting system equipped for individuals with disabilities” by January 1, 2006.³¹³ And as of January 1, 2007, any new equipment purchased with Title II funds must be accessible to people with disabilities.

Optical scan systems do not, as a general rule, allow independent voting by people with disabilities.³¹⁴ Braille ballots are one option, but their capacity to improve accessibility is limited, since

---

³⁰⁹See Paul Herrnson, et al., *Characteristics of Contemporary Voting Machines* (October 2003), available at http://www.capc.umd.edu/rpts/md_evote_ContempVotingMach.pdf.

³¹⁰AAPD, *supra* note 15, 195, 308, at 6.

³¹¹Hollister Bundy, *Election Reform, Polling Place Accessibility, and the Voting Rights of the Disabled*, 2 ELECTION L.J. 217 (2003); see also AAPD, *supra* note 15, 195, 308, at 27 (describing accessibility features of different DRE models, including whether they allow curbside voting).

³¹²See Disability Rights Education and Defense Fund, *Guide to Voting Equipment Usability for People with Disabilities* (2003).

³¹³42 U.S.C. § 15481(a)(3). Jurisdictions could comply with HAVA’s mandate by moving to a dual system in which one type of equipment is provided for people with disabilities and another is provided to able-bodied voters. As a policy matter, it is dubious whether jurisdictions should implement dual voting systems. Designating one machine for disabled people and another for all others is likely to arouse resentment on the part of non-disabled voters, and will also prevent multiple disabled voters from voting at the same polling place at the same time.

³¹⁴Paul S. Herrnson, et al., *Characteristics of Contemporary Voting Machines* (Oct. 2003) (listing features of optical scan and DRE voting equipment, including accessibility features); see also *AAPD v. Hood*, 310 F. Supp. 2d 1226 (describing non-accessible optical scan equipment purchased by Duval County, Florida).

only about 10% of people who are blind read braille.³¹⁵ There is a system relying on “tactile ballots” and audiotapes to accommodate visually impaired voters.³¹⁶ While this system, at least in theory, allow people with visual disabilities to vote independently, it is time consuming and does not allow them to verify that they have marked their ballots correctly.³¹⁷ One voting equipment vendor, however, is now marketing a machine that it advertises as allowing people with visual and manual impairments to mark ballots independently.³¹⁸ This system is best thought of as a hybrid between a DRE and optical scan. Disabled voters would make their choices through a DRE-like device; the machine would then print a paper ballot, to be read by an optical scanner. Although a promising technology, this equipment has yet to be implemented in any actual election.

From the standpoint of language access, DREs may also provide significant advantages over their paper-based rivals, although there is a pressing need for further research on this subject. DREs can accommodate multiple languages with relative ease.³¹⁹ As with an ATM, the voter may simply select the language in which he or she wishes to vote at the start of the voting process. The advantage of DREs, in comparison with other systems, is that they allows the non-English proficient voter to cast his or her vote secretly and independently, without relying on assistance from a poll worker or other third party. With precinct-count optical scan equipment, by contrast, the voter may need assistance from a poll worker in determining how to place the ballot through the counter – and in determining what should be done, in the event that the counter indicates that there has been an overvote or undervote.

---

³¹⁵AAPD, *supra* note 15, 195, 308, at v; *see also* GAO, *supra* note 308, at 36.

³¹⁶*See* Waterstone, *supra* note 195, at 363. The equipment relies on raised dots that voters feel in order to make their choices. http://www.electionaccess.org/Bp/Ballot_Templates.htm; *see also* *Voting Gets Easier for Blind Electors*, available at <http://www.lgcnet.com/pages/products/elections/mar12.htm>.

³¹⁷GAO, *supra* note 308, at 35-36. The only way for visually impaired voters to check on whether they have voted correctly would be to install ballot counters at the polling place, with an audio capacity that would allow choices to be read back to the voter, before the vote is actually cast. *See* Herrnson, *supra* note 314.

³¹⁸The machine, the “Automark” is being marketed by ES&S. *See* <http://www.essvote.com/HTML/products/automark.html>.

³¹⁹League of Women Voters, *Questions and Answers on Direct Record Electronic Voting Systems and the Proposal to Require a Voter Verified Audit Trail (VVPT)*, available at http://www.lwv.org/join/elections/HAVA_QAonDRE.pdf.

The opportunity to vote independently can be especially valuable in jurisdictions where immigrant voters may be subject to harassment, intimidation, or simply less-than-hospitable treatment from those working the polls. It may also be useful in those jurisdictions in which there are not an adequate number of poll workers who speak the native language of non-English proficient voters.

In addition, DRE systems would make it more economical for counties to provide multilingual access in situations where they would not be required to do so under the DRE, because they avoid the printing costs associated with printing ballots in multiple languages. If, for example, a voting jurisdiction is just below the 5%/10,000 voter threshold under the VRA, concerned citizens may still ask that the county exceed its minimum obligations under the VRA. This is particularly appropriate in a case where a language minority group, such as Thai speakers, is geographically concentrated within a part of the county. Under these circumstances, it would be much easier for counties using DRE systems to exceed their VRA obligations by providing language accessibility, than it would for counties using paper-based systems to do the same. DREs avoid the higher printing costs that would be required to provide dual or multi language ballots with paper-based systems.

That is not to say that jurisdictions that choose to use paper-based voting equipment would be in violation of Section 203. It is certainly possible to comply with the mandates of the VRA and HAVA with the implementation of optical scan ballots. But in terms of promoting the goal of providing equal access to disabled and non-English proficient voters, then, DREs may offer significant advantages.

D. Tallying the Results

The evidence identified above allows for a qualitative comparison of different voting technologies to be made, in terms of each of the four equality norms identified above. The chart below assesses the performance of punch cards, central-count optical scans, precinct-count optical scans, first-generation DREs, and second-generation DREs, according to each of these norms.³²⁰ A “+” is used to indicate that the technology performs well in this area, and a “-” to

---

³²⁰Hand-counted paper ballots, lever machines, and Datavotes are omitted, due to the limitations of these technologies, which makes jurisdictions unlikely to move to them.

indicate relatively poor performance.³²¹

	Race	Disability	Language	Accuracy
Punch card	–	–	–	–
CC-OS	–	–	–	–
PC-OS	+	–	–	+
Old DRE	+	–	–	–
New DRE	+	+	+	+

This chart is necessarily rough, particularly given the need for further research on the accessibility features of different voting equipment. It nevertheless captures the fact that, as set forth in the preceding discussion, DREs offer significant benefits from an equality perspective, in comparison to their paper-based rivals. Both DREs and precinct-count optical scan systems perform well, in terms of reducing overvotes and overvotes. Both these systems may also reduce the racial gap in uncounted votes, although the evidence on precinct-count optical scans is somewhat ambiguous. When it comes to reducing promoting disability access, DREs fare better than any paper-based technology. They also have the potential to improve language access.

There is unquestionably a pressing need for further research on how different voting technologies perform with respect to each of these norms, particularly disability access and multilanguage access.³²² This must include an assessment of how people interact with the technology in real-world election environments. Nevertheless, the information presently available indicates that, from the perspective of promoting equality, electronic voting enjoys considerable advantages over existing paper-based technology.

---

³²¹“Accuracy” is used as shorthand for the goal of avoiding unintentional residual votes. As noted above, this is different from the goal of inter-jurisdictional equality, which can at least theoretically be achieved through the implementation of any type of voting technology, including ones that there are inaccurate. But to the extent there are differences in accuracy among different types of equipment used within a state, conversion to the more accurate form of equipment provides the more plausible means of remedying this inequality.

³²²Paul Herrnson and his colleagues with the Center for American Politics and Citizenship are currently undertaking a project, funded by the National Science Foundation, to test the usability of DRE and optical-scan voting equipment, including their accessibility features. See http://www.capc.umd.edu/rpts/VotingTech_par.html.

III. SECURITY, TRANSPARENCY AND ELECTRONIC VOTING

Equality is a central consideration in assessing different voting technology. But it is not the only consideration. This part considers two other democratic values that should also be taken into account in considering voting technologies: security and transparency. I summarize the concerns of those who have been most critical of existing DRE technology, as well as the analyses that have been conducted of security vulnerabilities. I then consider the vulnerabilities of paper-based voting, in an effort to provide a comparative perspective on the relative risks associated with different technologies. I conclude that, while there are legitimate reasons to be concerned about the implementation of DRE voting, paper should not be considered the gold standard. In particular, it is questionable whether adding printers to DRE machines is either a workable or effective solution to the vulnerabilities that exist.

A. The Risks of Electronic Voting

1. *Two More Democratic Values*

As important as equality is, there are two other values that also warrant attention, in comparing different types of voting technology. The first is *security*, which I here use to mean the resistance of votes and vote totals to fraud and other forms of manipulation. This value encompasses a set of related concerns that have been raised about present-generation DRE technology. This includes the possibility that malicious code could be inserted into the software to alter the results of an election, that DRE units could be subjected to attacks on the day of the election, and that the vote tallies could be manipulated at the central counting location.

The second value is *transparency*, by which I mean the technology's capacity to produce auditable results, in which both candidates and voters can justifiably have confidence. This value is related to security, insofar as a system that allows for effective auditing will be less vulnerable to tampering. I categorize it as a distinct democratic value, in order to emphasize that it is important not only for a voting system to be resistant to manipulation, but also for the polity to have assurance that elections are conducted on the square. It is at least theoretically possible to have a system that is in fact resistant to fraud and error, but which nevertheless fails to provide assurances to citizens that their votes were accurately counted, resulting in a loss of public confidence.

2. *Identifying Vulnerabilities*

Much has been said about the security of electronic voting technology over the past two years. The concerns arise from the fact that, with contemporary DRE machines, the voter does not see an actual paper ballot but instead a representation of that ballot. The ballot itself is stored in redundant internal locations within the DRE. In this respect, DREs are similar to lever machines, in which voting requires moving “counters” that are not visible to the voter.³²³ The difference is that DREs are much more complicated, relying on complex software that only sophisticated technical analysts are capable of understanding. Some have argued that this would make it easier to insert malicious software, such as a so-called “Trojan Horse,” that could alter election results while escaping detection.³²⁴

When addressing the security of DRE voting technology, it is important at the outset to identify and differentiate the specific risks that exist.³²⁵ The Hopkins Report³²⁶ and subsequent studies have identified three general areas in which present-generation DREs may be vulnerable to fraud or other forms of manipulation.

Insertion of Malicious Code. The first area of vulnerability, which has received the most intensive scrutiny from the technical community, is the code upon which DREs rely. The Hopkins study itself was based solely upon source code for Diebold’s TS voting machine, which was left on an open website.³²⁷ The study’s analysis concluded that the code had serious flaws that could permit tampering by software developers and others.³²⁸ The study made certain assumptions (some of which turned out to be incorrect) about how the system would be operated in actual elections.³²⁹ It nevertheless generated genuine concern that a machine manufacturer or software developer could deliver software to the jurisdiction that is

---

³²³Fisher, *supra* note 24, at 5.

³²⁴*Id.* at 5-6, 13.

³²⁵Michael Ian Shamos, *Paper v. Electronic Voting Records – An Assessment* § 1.2 (April 2004)(“It is pointless to discuss the security of a computer system in the absence of a well-articulated list of threats”).

³²⁶*See supra* note 63 and accompanying text.

³²⁷Kohno, et al., *supra* note 63, at 4.

³²⁸*Id.* at 3.

³²⁹Science Applications International Corporation, *Risk Assessment Report: Diebold AccuVote-TS Voting System and Processes* III (Sept. 2, 2003)(“SAIC Report”).

programmed to switch votes to a favored candidate.³³⁰

In theory, the software could be programmed to correctly display to voters their choices, but record their choices differently. for a voter intending to vote for Bush, for example, the screen that appears at the end of the voting process would display the voter's intended choice, but could be programmed to switch every fifth "Bush" vote to a "Kerry" vote in the redundant internal memory. Due to the length of the source code, some technologists argue, such malicious code might not be detected before an election.³³¹ The malicious source code might even be programmed to destroy any trace of itself afterwards, thus avoiding detection even after an election. Through this means, some computer scientists hypothesize, an election could be "stolen" without anyone knowing it.

Attacks on Individual Machines at the Polling Place. The second category of vulnerability is that individual DRE units could be subjected to an attack, before or during an election.³³² This was one of the principal vulnerabilities upon which the Hopkins Report focused. Such an attack could be as crude as taking a sledgehammer to the voting machine or, somewhat more plausibly, attempting to open the machine by force.³³³

An attack on individual machines might also be accomplished through more subtle means. As noted above, present-generation DREs are typically activated by inserting a credit-card sized "smartcard" into the voting unit, which in turn causes an image of the ballot to be displayed upon the screen. The Hopkins Report raised the possibility that voters could create "homebrew" smartcards, and using them in the voting terminal. This would, in theory, allow the attacker to cast multiple votes without detection.³³⁴

The report also raised the possibility that an attacker could manufacture homebrew "administrator" cards, which gives access to the unit's controls. This would allow the attacker to incapacitate the machine and, again theoretically, shut down polling places. While access to administrative controls requires a PIN number, the Hopkins Report asserted that this number could easily be ascertained by anyone who know the system's protocol.³³⁵

Tampering with Election Results. The third area of

---

³³⁰Shamos, *supra* note 325, §1.2.4.

³³¹Fisher, *supra* note 24, at 13.

³³²Shamos, *supra* note 325, §1.2.2.

³³³*Id.* §1.2.1

³³⁴Kohn, et al., *supra* note 63, at 9-10.

³³⁵*Id.* at 10-11.

vulnerability is on the back-end of elections, after the votes have been cast but before they are tallied. The Rubin report hypothesized that, after being stored on individual DRE units, the voting records would be transmitted from the polling place to a central location over a network connection. They identified the possibility that an attacker might “inject fake votes to a back-end tabulating authority by impersonating a legitimate voting terminal.” By so doing, the attacker could either alter existing votes or create new ones.³³⁶ Thus, even though the vote was correctly recorded by the machine, erroneous votes might be transmitted to the jurisdiction’s central counting location, thereby resulting in alteration of the election results.³³⁷

3. *Analyzing Vulnerabilities*

The source code used by DREs is, of course, only one component of the machine. Moreover, the machine itself is just one component of the larger election system within which it operates. An analysis of the security risks with DREs (or for that matter, any other voting technology) therefore cannot be understood in isolation from this system, of which the hardware and software is only a part.³³⁸

In July 2003, the California Secretary of State released a task force report, which found that “in theory, there is a possibility of a security threat with DRE voting equipment.” While the task force was unanimous in finding that there was “no proven instance of such an attempt at fraud” in the years that DRE equipment had been in use, some members of the task force believed that there was a high risk of attack.³³⁹ The task force report included a number of recommendations on how DRE security should be improved.³⁴⁰ It recommended that some sort of voter verified audit trail should be required for machines purchased as of 2007. However, the task force

---

³³⁶*Id.* at 15.

³³⁷See Shamos, *supra* note 325, §1.2.3.

³³⁸Roy G. Saltman, *Auditability of Non-Ballot, Poll-Site Voting Systems* 3 (Mar. 31, 2003).

³³⁹Shelley, *supra* note 156, 339, at 18.

³⁴⁰Among the California task force’s recommendations were: (1) improvement of federal testing standards and procedures, (2) enhancement of the state certification process, (3) random audits of machines to check the software code, (4) parallel testing of machines, (5) improved logic and accuracy testing, (6) tightly controlling system software, (7) requiring background checks of vendors, and (8) providing a “review screen” on all DREs for voters to check their votes. *Id.* at 30-36.

majority did *not* recommend that a voter verifiable *paper* audit trail be required, recognizing instead that there might be other means by which to audit election results, and thereby ensure transparency.³⁴¹

Prompted by the Hopkins Report, Maryland commissioned a risk assessment report of its Diebold's AccuVote TS system, which was conducted by Science Applications International Corporation ("SAIC"). SAIC found that many of the statements made in the Hopkins Report were technically correct, but that its authors lacked a thorough understanding of the environment in which the equipment was to be implemented.³⁴² In particular, the Hopkins Report did not take into account the procedural controls that are to be followed in running a real-life election.³⁴³ The Hopkins Report also raised the possibility that "voting terminals could communicate over insecure phone lines," when in fact the DRE units are not attached to the network.³⁴⁴

Notwithstanding the counterfactual assumptions of the Hopkins Report's analysis, the Maryland report found several flaws in the Diebold system. It also recommended a number of measures to reduce the security risks associated with the Diebold system.³⁴⁵

Maryland subsequently commissioned a second report, authored by RABA technologies.³⁴⁶ For the RABA report, a "red team" of computer experts were given access to DRE voting units and allowed to experiment with a variety of attack scenarios. This report thus focuses on the second set of security vulnerabilities identified above. Like the SAIC report, the RABA report found that Diebold's

---

³⁴¹*Id.* at 36-46.

³⁴²SAIC, *supra* note 329, at 9; *see also* RABA Innovative Solution Cell, *Trusted Agent Report: Diebold AccuVote-TS Voting System* 11 (January 20, 2004).

³⁴³For example, the Hopkins Report expressed concern about the possibility that smartcards used to operate DRE machines would be sent through the mail, which they are not. *Id.* at III. One of the report's principal co-authors has since acknowledged that using homebrew smartcards to cast multiple votes is unlikely to occur without being detected. *See* Avi Rubin, *My Experience as an Election Judge in Baltimore County*, available at <http://avirubin.com/judge.html>.

³⁴⁴*Id.* at 9.

³⁴⁵The recommendations included: (1) bringing the system into compliance with existing state security standards, (2) apply cryptographic protocols to protect vote tally transmissions, (3) establishing a formal process for the review of audit trails, (4) conducting security awareness training and education for election officials, (5) changing default passwords, (6) verifying that the certified version of the software is loaded before implementation, (7) developing an integrated set of policies for all jurisdictions. *Id.* at IV-V.

³⁴⁶RABA Innovative Solution Cell, *Trusted Agent Report: Diebold AccuVote-TS Voting System* (January 20, 2004).

DRE system was subject to several vulnerabilities, including: (1) duplication of smartcards and supervisor cards, (2) opening up the machines to access the hardware and software components used to register votes, (3) removal of the memory card used to record voters' cast ballots, (4) using a disabled access card to "crash" a DRE terminal.³⁴⁷ The RABA report also identified vulnerabilities in the software used to collect and tally precinct results.³⁴⁸

The likelihood of such an attack in an actual election nevertheless remains the subject of intense disagreement. This is partly because the RABA report, while avoiding the mistaken assumptions set forth in the earlier Hopkins study, had an open access to DRE machines that is unlikely – if not impossible – in a real election if proper procedures are followed.³⁴⁹

In a paper assessing the relative risks of paper and electronic voting records, Prof. Michael Shamos of Carnegie-Mellon's computer science department examines each of the three categories of security vulnerabilities identified above.³⁵⁰ He concludes that while the hypothesized threats are not beyond the realm of possibilities, precautions can be taken – and at least in some cases are already being taken – that considerably lessen the likelihood of their occurrence. Thorough testing of both hardware and software can decrease the likelihood of malicious source being used to alter votes. Shamos also notes that contemporary DREs store ballot images both within the machine and on redundant memories, in individual modules that can be transported. For this reason, an attack on the transmission of data from precincts to a central-count location is unlikely to be successful, given that the electronic ballots are already sorted in redundant locations.³⁵¹ While no one suggests that the use of DREs is free from risk, procedural safeguards can reduce the possibility of attacks occurring in real-world elections.

At the same time, the lack of auditing transparency creates a legitimate concern.³⁵² Even if the machines are resistant to fraud and other forms of manipulation, it is important that voters be provided with reasonable assurance that their votes will be counted accurately. This does not mean that they must understand the inner workings of the machine. If that were the standard, then no system every

---

³⁴⁷*Id.* at 16-20.

³⁴⁸*Id.* at 20-22.

³⁴⁹*See* Rubin, *My Experience as an Election Judge*, *supra* note 343.

³⁵⁰Shamos, *supra* note 325, §1.2

³⁵¹*Id.* §1.3.

³⁵²VOTING: WHAT IS, WHAT COULD BE, *supra* note 27, at 45-47.

developed would be satisfactory, since voters often do not know precisely how the system operates – for example, prior to the Florida 2000 election, few citizens likely had much understanding of the process by which votes are counted. What it does mean is that the voting system should be reasonably open to public scrutiny, so that the process through which votes are cast and counted remains accountable to the citizenry.

B. Is Paper the Answer?

The flurry of attention to DRE security has caused many advocates to call for a “voter verified paper audit trail,” prompting bills to mandate this device in both the House and the Senate.³⁵³ As noted above, HAVA already requires a that voting machines produce a permanent paper record that can be used in the case of manual audits.³⁵⁴ The new legislation, however, would require attached printers that would generate a paper replica of the electronic ballot *at the time of voting* – the contemporaneous paper record or “CPR” – which the voter could review before casting his or her vote.

While the goals of security and transparency are vital, it is questionable whether the CPR is a workable or effective solution to the legitimate concerns that exist regarding present-generation DRE technology. As set forth below, there are three problems with the argument to require a CPR: *First*, it relies on the false assumption that paper-based systems are inherently more accurate and reliable than paperless ones. *Second*, it disregards both long and recent experience demonstrating the vulnerability of paper-based systems to fraud and error. *Third*, it fails to comprehend the practical problems in actually implementing a system that is capable of printing out a contemporaneous paper record, yet preserves voter privacy and election security.

1 *A Comparative Perspective*

What has largely been missing from the voting technology debate is a comparative assessment of the relative risks and benefits of different voting technologies. Just as the public discourse has largely overlooked the comparative *benefits* of DREs, in terms of advancing voting equality, it has also failed to examine the comparative *risks* of DREs compared with paper based systems.

The only published appellate decision to address a challenge

---

³⁵³H.R. 2239 (Holt); S. 2313 (Graham/Clinton).

³⁵⁴42 U.S.C. § 15481(a)(2)(B).

to DREs properly emphasizes the importance of a comparative analysis, when considering the risks of voting technology. In *Weber v. Shelley*, the court rejected a constitutional challenge to the use of DRE equipment that did not generate a contemporaneous paper record.³⁵⁵ In support of the argument that paperless DREs denied her voting rights, the plaintiff had submitted declarations from leading supporters of the CPR requirement. The Ninth Circuit concluded that plaintiff had raised “at most a hypothetical concern about the ability to audit and verify election results.” Completely absent from plaintiff’s evidentiary case, including her expert declarations, were any indication that the paperless DRE was “inherently less accurate, or produces a vote count that is inherently less verifiable, than other systems.”

What was missing, in other words, is any evidence showing that DREs are *comparatively* less accurate or reliable than other systems. The opinion proceeded to note that no voting system is perfect, and that the “unfortunate reality is that the possibility of electoral fraud can never be *completely* eliminated, no matter what type of ballot is used.”

That is not, of course, to say that paperless electronic systems are without risks. In arguing that DRE voting technology should be required to generate a contemporaneous paper record, DRE skeptics have pointed to a number of problems that have emerged in the implementation of electronic voting. These include: (1) voters being given incorrectly coded smartcards, causing the wrong ballot be brought up on the screen, (2) the machine used to encode smartcards not functioning properly and thereby causing delays in polls opening, (3) discrepancies between the number of voters signing in at the polling place and the number of ballots recorded.³⁵⁶

The significance of the problems that have occurred in the implementation of DRE systems should not be minimized. At the same time, such difficulties in the implementation of voting technology must be distinguished from the concerns of attacks upon the machines (for example, through the insertion of malicious source code). Requiring a contemporaneous paper record would do nothing to address the implementation difficulties that have marred the introduction of electronic voting in some jurisdictions. Moreover, as

---

³⁵⁵347 F.3d 1101 (9th Cir. 2003).

³⁵⁶ Other problems, including allegations that some votes are missing from vote totals, have been reported in Florida and other states. For an itemization of these alleged incidents, see Amicus Brief Filed on Behalf of the Electronic Frontier Foundation, et al., in *Stewart v. Blackwell*, at 3-8 (Aug. 5, 2004) available at http://www.eff.org/Activism/E-voting/20040805_Ohio_Amicus_Brief.pdf.

explained below, it is far from clear that adding paper to the voting process would effectively address the security vulnerabilities of DRE voting technology.

2. *Historical Problems with Paper*

Even the most vigorous critics of DRE technology acknowledge that paper ballots are susceptible to manipulation.³⁵⁷ As Prof. Shamos notes, “[e]very form of paper ballot that has ever been devised can and has been manipulated, in general with considerable ease.”³⁵⁸ Fraudulent manipulation of paper ballots stretches back to the use of hand-counted paper ballots.³⁵⁹

Among the most famous voting incidents of the last century was Lyndon B. Johnson’s 1948 election to the United States Senate. Several days after the election, in what was still a neck-and-neck race, 203 additional votes (202 of them cast for LBJ) were found, giving the election to LBJ by a margin of 87 votes statewide.³⁶⁰ The court reports, history books, and newspapers are filled with similar accounts of paper ballots being manipulated. While the below list is not intended to be comprehensive, it illustrates the types of problems that have occurred with paper ballots:

- In *Ex Parte Siebold*, a 1879 Supreme Court decision, the Supreme Court let stand fraud convictions for placing extra ballots in a ballot box during and 1878 Maryland congressional election,³⁶¹
- In a 1937 decision by a federal district court in Missouri, testimony revealed that clerks and judges had altered more than 100 ballots in a Kansas City precinct,³⁶²
- The U.S. Supreme Court in *United States v. Saylor* upheld

---

³⁵⁷See *Schade v. Lamone*, Order Denying Preliminary Injunction, Sept. 1, 2004, at 3 (describing agreement of experts from both sides in DRE challenge, that “the use of paper ballots is the least accurate of all systems and lends itself to the most chicanery”)

³⁵⁸Shamos, *supra* note 325, §2.3.

³⁵⁹In New York City’s 1844 election, for example, some 55,000 people cast ballots, despite the fact that its entire voting pool consisted of 41,000 people. LARRY J. SABATO & GLENN R. SIMPSON, *DIRTY LITTLE SECRETS* 276 (1994).

³⁶⁰*Id.* at 278.

³⁶¹100 U.S. 371 (1879).

³⁶²19 F. Supp. 972 (W.D. Mo. 1937).

convictions arising from the 1942 Kentucky senatorial election for tearing unvoted ballots from the official ballot book and stub book, and inserting the false votes into the ballot box,³⁶³

- Court decisions during the 1970's report ballot recount ballot stuffing in various states, including West Virginia, New Hampshire, and Illinois,³⁶⁴
- Chicago's 1982 mayoral race, during which over 100 incidents of voting irregularities, including incorrectly ballot spoilage, pre-marked ballots, disparities in the number of votes cast, double voting, and election judges punching straight party tickets before voting,³⁶⁵
- In Philadelphia's 1993 election for a state senatorial seat, fraudulent absentee ballots were cast by one side's campaign, including 600 absentee ballots cast after the deadline by people who were not registered.³⁶⁶
- During a 1994 election for chief justice of the Alabama Supreme Court, ballot boxes were missing, seals on vote containers had been broken, and ballot boxes were left open in unwatched public rooms,³⁶⁷

Nor can security breaches with paper-based voting be dismissed as a thing of the past. Even aside from Florida's 2000 election, numerous incidents of fraud or error with paper ballots have been reported in the past four years:

---

³⁶³322 U.S. 385 (1944).

³⁶⁴*United States v. Barker*, 514 F.2d 1077 (7th Cir. 1975); *United States v. Anderson*, 481 F.2d 685 (4th Cir. 1973); *In re. W. Bernard Smith*, 158 W. Va. 13 (1974); *New Hampshire v. Perry*, 113 N.H. 529 (1973).

³⁶⁵HEARING BEFORE THE SUBCOMMITTEE ON THE CONSTITUTION OF THE COMMITTEE ON THE JUDICIARY, UNITED STATES SENATE, 98TH CONGRESS, FIRST SESSION, ON THE NEED FOR FURTHER FEDERAL ACTION IN THE AREA OF VOTING FRAUD, CHICAGO, IL, SEPT. 19, 1983, at 75-79. *See also United States v. Olinger*, 759 F.2d 1293 (7th Cir. 1985)(upholding convictions for election fraud in 1982 Chicago election).

³⁶⁶SABATO & SIMPSON, *supra* note 359, at 278-83; *see also Marks v. Stinson*, 1994 U.S. Dist. LEXIS 5273.

³⁶⁷*Id.* at 283-88.

- In New Mexico's 2000 presidential vote, some 252 early-voting ballots were reported missing and another 1,300 to 1,600 "damaged votes" were rejected because of stray marks or other problems,³⁶⁸
- During a 2000 election in Benton County, Arkansas, a ballot box was "misplaced," and only to reappear after some 12 hours with its label peeled off and the box wet from sitting out in the overnight rain,³⁶⁹
- The City of San Francisco has had a sordid history of election problems, which includes eight ballot-box lids found floating in the San Francisco Bay and 240 uncounted ballots found stuck in machines in 2001's election,³⁷⁰
- In a 2002 Illinois assembly election, ballots cast in one of the precincts could not be located at all, causing the trial judge to order a new election,³⁷¹
- In Broward County, Florida, a box containing 268 unopened ballots was found in a file cabinet approximately four months after the September 2002 election,³⁷²
- In Hamilton County, Tennessee earlier this year, a box of 189 ballots was uncounted and another 2,591 ballots were not included in the final election tally.³⁷³

The point of this list is not to demonstrate that paper-based voting equipment is inherently insecure. Instead, the purpose of providing this non-exhaustive list of examples is to demonstrate that

---

³⁶⁸Leslie Hoffman, *Gores Lead Plummets in New Mexico*, ALBUQUERQUE TRIBUNE, Nov. 10, 2000, at A1.

³⁶⁹Laura Kellams & Kirstan Conley, *Little Flock's Vote Box Misplaced for 12 Hours, Wet Label Peeled Off Container, Delayed Count*, ARK. DEMOCRAT-GAZETTE, Nov. 9, 2000, at A1.

³⁷⁰*San Francisco Finds Ballots in Machines*, N.Y. TIMES, Nov. 30, 2001, at A18.

³⁷¹334 Ill. App. 3d 1017 (2002). Although there was no dispute as to the missing ballots, the appellate court reversed the order for a new election.

³⁷²Scott Wyman, *Oliphant Fires Another Staffer; Elections Chief Hires Accounting Firm*, SUN-SENTINEL, at 18.

³⁷³Andy M. Drury, *Election Records Unsealed; TBI Probe Continues*, CHATANOOGA TIMES FREE PRESS, Apr. 8, 2003, at B1.

no form of technology – either paper-based or electronic – is immune to fraud and error. At the very least, it should caution against assuming that a paper replica of the electronic ballot will ensure security and transparency.

3. *Problems with the Contemporaneous Paper Record*

Largely overlooked in the debate over whether to require that DREs print out a contemporaneous paper record are the practical difficulties in making such a system work. The limited experience that exists with the CPR thus far reveals serious questions about (1) whether it is a practicable solution, and (2) whether it is an effective means of preventing fraud, and thereby promoting the values of security and transparency.

a. *Practicability*

The anonymity required in the process of voting makes the implementation of a paper ballot printout more complicated than an ATM transaction, to which it has often been compared. The purpose of an ATM receipt is to provide the voter with a record of the transaction that he or she may take with him. By contrast, the purpose of the “voter verified paper audit trail” (as the name suggests) is to provide an audit trail for election officials, that can be used to reconstruct voters’ intended choices and to compare them to the electronic record. In order to preserve the integrity of that audit trail, the printed paper record must be generated in a way that the voter can see it but not touch it.

This is also necessary, in order to prevent voters from walking off with the paper copies of the electronic ballot – which could then be used in vote buying schemes, compromising the integrity of elections.³⁷⁴ It is therefore incorrect to refer to the paper record generated by DREs as a “receipt,” since the voter does not actually receive a copy of the paper record. Instead, he or she views it behind a glass or screen – which allows the paper record to be seen but *not* touched.

The experience of jurisdictions that have attempted to implement DREs capable of generating a contemporaneous paper record illustrates the practical difficulties inherent in making such a system work in a real-world election. Introducing an additional piece

---

³⁷⁴Ted Selker & Jon Goler, *Security Vulnerabilities and Problems with VVPT, VTP Working Paper 3* (Apr. 2004), available at http://www.vote.caltech.edu/Reports/vtp_wp13.pdf.

of equipment can complicate the voting process, resulting in confusion on the part of both voters and poll workers. The introduction of the CPR has proven to be no exception. In the two places that attempted to use a CPR system on a limited basis, moreover, the device has proved problematic at best.

Sacramento County used DREs with attached printers for early voting in its 2002 election. While voters in Sacramento reacted favorably to touchscreen voting, as have voters in other jurisdictions, “[a]dding a printer and paper to the voting process was a challenge.” As the Sacramento registrar explained:

It was new to voters and some did not even want to see the printed record. Some voters liked the option of reviewing the printed record, some did not care, and some did not want to take the extra seconds to see it. It was confusing for some because they thought they could take it with them....

If the printed record jams, the machine is out of service until someone can take care of the problem .... A few times when the printed record stuck they had to be extracted with many creative tools that were on hand at the early voting site such as a windshield wiper or back scratcher .....

The voter viewed the printed record through a plastic shield in front of the machine. Voters complained that it was difficult to read because of the length of the ballot, size and darkness of the print and the location of the shield. Most voters wanted to remove the paper copy and check it out before it went back into the machine....

There was concern that the machines would have problems sorting the voter’s printed receipts. It was decided to empty the tray every ten voters. This procedure was stopped. The machines must not be opened during the day to empty the tray.³⁷⁵

Sacramento’s experience highlights the practical difficulties

---

³⁷⁵Memorandum from Ernest Hawkins, Register of Voters Sacramento County, to Bob Jennings, Chairman, Voting Systems and Procedures Panel, Re. Early Voting Using the Avante System, Nov. 12, 2002 (copy on file with author).

in implementing a DRE system capable of generating the “voter verifiable paper trail.” Even when used in early voting – which includes a much smaller number of voters than in a regular election and can be conducted in a more tightly controlled location – practical impediments to effective implementation emerged, including: (1) voters trying to take the paper records with them, (2) printed ballot replicas being removed from the tray where they are held, (3) voter privacy being compromised when the tray is opened during the voting day, (4) voters declining to review the paper records before casting their votes, (5) printers jamming, (6) scarce polling place resources being consumed by fixing printer jams, (7) difficulty reading paper ballot records, and (8) voter confusion.

A CPR system was also tested on a limited basis in Wilton, Connecticut’s November 2003 election. After that election, the deputy registrar commented that the “ease of use and human factors ... are appalling.” The voting system created “numerous problems for voters and placed great stress on the poll workers ....”³⁷⁶

While some of these difficulties may ultimately be resolved through refinement of the machines and voter experience, there can be little doubt that the adding a printer would place an additional strain on poll worker resources – and thus strain this component of our elections systems even further. Reports published in the wake of the 2000 election document that poll worker resources in many communities, especially urban ones, are already stretched thin.³⁷⁷ Adding on another piece of equipment that poll workers (many of them elderly) will have to deal with can be expected to complicate the election process.

A recent paper by Ted Selker and Jon Goler of MIT assesses the practical problems with the CPR.³⁷⁸ They find that:

[The CPR] complicates two of the top three problems that have compromised more than one percent of American votes in 2000: equipment problems and polling place operations. It complicates the setup, teardown, and operation of the ballot place. It complicates polling place procedures during the vote. It gives extra and difficult tasks for a person to do and increases the problems with user experience and user interface. It also increases the length of time of voting,

---

³⁷⁶Report of Wilton, CT Deputy Registrar (2003).

³⁷⁷House Minority Caucus Report on Election Reform (2001).

³⁷⁸Selker & Goler, *supra* note 374.

which makes it, with more steps, easier to make mistakes.

Implementation of the CPR is thus considerably more difficult than some advocates' public statements might lead one to believe. The difficulties relate not only to costs – for which no reliable estimates are available – but also to the practical imperatives of election administration. While touchscreens are sometimes compared to ATM machines, ATM's need not be transported to and from hundreds of precincts each election day. Voting machines must be transportable. When they break, longer lines at the polling place will result. As numerous reports since the 2000 election have documented, the nation's polling places are dramatically understaffed, often by elderly poll workers. Requiring the transportation and implementation of an add-on device would considerably complicate an already complicated process, and further tax scarce poll worker resources. Worse still, because of the practical difficulties and uncertain costs of implementing touchscreens with a CPR, the likely result of imposing such a requirement is to force counties to stick with inferior paper-based systems such as the discredited "hanging chad" punch card.

This does not mean that the CPR is unworthy of further experimentation. Nevada, for example, is experimenting with a CPR system in the 2004 election.³⁷⁹ While some early reports on the use of this equipment have been favorable, election officials continue to express serious doubts about whether the CPR will function effectively – particularly in urban areas where there are insufficient poll worker resources.³⁸⁰ It thus remains uncertain at best whether the CPR is a workable solution to the vulnerabilities that have been identified with DRE technology.

b. Efficacy

The argument that the CPR would serve as an effective means of policing fraud and error depends upon the electronically vote tallies being checked against the paper copies of ballots in a recount.

---

³⁷⁹ Erica Werner, *Nevadans Get Look at New Voting Machines*, RENO GAZETTE-JOURNAL, Jul. 17, 2004.

³⁸⁰ Rachel Konrad, *Nevada's E-Vote Free of Serious Problems*, NEWS OBSERVER, Sept. 16, 2004, available at <http://newsobserver.com/24hour/technology/story/1657720p-9391057c.html>; see also Dan Tokaji, Equal Vote Blog, Sept. 16, 2004, available at http://equalvote.blogspot.com/2004_09_01_equalvote_archive.html#109536625385553001.

Should the results of the recount differ from the electronic tally, CPR advocates urge that the paper replicas should be used. This would supposedly provide assurance against fraud and manipulation. This argument thus rests on three assumptions: (1) that recounts will actually be conducted, (2) that voters will actually have checked and thereby “verified” the paper replicas, and (3) that the paper replicas will be more reliable evidence of voters’ intended choices than their electronic counterparts. All of these assumptions are open to question.

As an initial matter, it is doubtful that recounts will serve as an effective check on DRE security – and therefore that they will do much to improve transparency – in real-world elections. For the CPR to serve as an effective check on DRE security, a recount must actually be conducted. In fact, very few states have laws requiring even limited manual recounts, unless the election is very close or a candidate or voter requests it (often at their own expense). As the chart displayed in Appendix B shows, only four states’ laws require automatic recounts.³⁸¹ In other states, a manual recount is triggered only in a close election, or in some cases where a losing candidate or voter requests it. For example, in Maine, a recount is triggered where the margin of victory is less than one percent.³⁸² If the hypothetical hacker were clever enough to insert malicious code into DREs, it is logical to assume that she would also be clever enough to ensure that the number of votes altered is large enough to avoid triggering an automatic recount – or even suspicion of wrongdoing that would lead to a candidate-initiated recount.

Even in those states where an automatic recount is required, regardless of whether the election is close, that recount is unlikely to serve as an effective check on manipulation of the type that has been hypothesized. That is because all those states require only a partial recount of voted ballots, which is unlikely to detect manipulation of the results. California, for example, has a law requiring a manual recount of 1% of voted precincts.³⁸³ Such a limited manual recount will provide little assurance that the election was conducted squarely.

---

³⁸¹Those states are California, Kentucky, New York, and West Virginia. Whether New York should be included in this list is debatable, since the pertinent statute does not actually require a recount but a “recanvass[ing]” of the vote. N.Y. Elec. § 9-208. This is presumably because New York has until now relied upon lever voting machines which do not produce a paper record. See New York State Help America Vote Act, *HAVA Implementation Plan* (Aug. 2003), available at 69 Fed. Reg. 14798, 14814 (Mar. 24, 2004).

³⁸²Maine Rev. Statutes § 737-A.

³⁸³Cal. Elec. Code § 15360.

In a congressional race, for example, a full recount of at least 250 precincts would be required to verify accuracy at a 90% confidence level (and even then, it would only do so with a 1.2% error margin).³⁸⁴ Thus, unless jurisdictions are prepared to conduct a full manual recount of all voted ballots, something that no one seriously advocates, the CPR will not provide an effective check on electronic voting results in close elections. And even with a full manual recount, arguments for a CPR requirement assume that the printer-generated ballot replicas will be more accurate than the electronically voted ballots, an assumption that is dubious at best in view of the likely prospect of printers sometimes failing and the vulnerability of paper ballot replicas to fraud and error.

The SAIC report addresses the contention that a voter verifiable audit trail would solve the DRE security problem. The Hopkins report asserted that “the only known solution” to the asserted flaws in DRE systems is the introduction of “a voter-verifiable audit trail.”³⁸⁵ But as the SAIC report correctly notes, “a printed paper ballot would still be subject to fraud.”³⁸⁶ Assuming the machines were rigged, a voter verifiable paper trail would do little to solve the problem:

A compromised machine could be programmed to record votes incorrectly, but provide a correct paper ballot to the voter. Only in the event of a total recount would this be discovered. Additionally, the process of hand counting the millions of votes is time consuming and is prone to error.³⁸⁷

Roy Saltman likewise concludes that it would be an error to assume that a paper trail is an effective solution for the problems that may occur with DRE voting technology:

If the intention of a printout from a DRE machine is to give the voter a sense of confidence that his or her vote was properly cast and properly processed, that confidence would be false. Due to the fact that the printout is created by the computer and is not a document-ballot, such a printout is a sop to the

---

³⁸⁴C. Andrew Neff, *Election Confidence* (2003).

³⁸⁵Kohn, *supra* note 63, at 2.

³⁸⁶Maryland Risk Assessment, at B-2.

³⁸⁷*Id.* at B-2.

layperson ignorant of the inner workings of the computers.³⁸⁸

Nor is there any reason to believe that voters would actually check to determine whether the paper record accurately records their intentions – something that would be extremely difficult with the CPR technology now being made available, which could generate printouts as long as 57 inches in jurisdictions with a large number of items on the ballot. Saltman notes that, while a working DRE that incorporates a contemporaneous paper trail might be developed, such a solution would necessitate attaching a printer to each terminal and would “negat[e] the value of a DRE because it uses paper ballots.”³⁸⁹

Electronic voting critics have pointed to problems that have occurred in the implementation of electronic voting in some jurisdictions. But the CPR would do little to remedy most of the problems that have actually occurred. For example in the March 2004 election, three California counties (Alameda, Orange and San Diego) experienced problems in the implementation of new electronic systems. The CPR would not have done anything to prevent the sort of problems that occurred in these three counties. In Orange County, some voters were given the wrong smartcard, causing the wrong electronic ballot to be displayed. A paper copy would not have solved this problem, but would only have replicated it. So too, the difficulties encountered in Alameda and San Diego counties with Diebold’s system could have been avoided through better procedures. In both these counties, the precinct control modules (“PCM’s”) used to encode smartcards reportedly failed to boot properly. In particular, poll workers should be given training in advance on the relatively simple “four-click” process for resolving the problem in a matter of minutes.³⁹⁰ A CPR requirement, however, would not solve these problems.

C. *Alternatives to Paper*

---

³⁸⁸*Id.* at 4.

³⁸⁹*Id.* at 4-5. He proceeds to suggest other, more viable alternatives to a contemporaneous paper trail, including recording of the votes on a removable diskette for use in the event of recounts, reconciliation of votes and overvotes, providing an opportunity for the voter to review his or her choices, more thorough testing of hardware and software, and an audit trail for software handling as possible solutions. *Id.* at 5-7.

³⁹⁰See Report of San Diego County Chief Administrative Officer (Mar. 10, 2004), available at <http://www.signonsandiego.com/news/politics/county/20040310-1315-report.html>.

The present answer to the question “Is paper the answer?” must therefore be “No.” That is not, however, to deny that it is vital to address the vulnerabilities of election systems relying on DRE technology. While a thorough exploration of the alternative means to improve DRE security and transparency is beyond the scope of this article, some of the most promising proposals are summarized below, listed roughly in order of ease of implementation. Those that could be implemented now with relatively little disruption of existing election systems are listed first, with changes that would require more substantial modifications to existing election ecologies listed further down.

Tighter Procedures. Among the changes most likely to enhance security and transparency are improvements to election procedures. In fact, changes to administrative procedures are at the top of the list of reforms recommended by the reports commissioned by the states of Maryland and California.³⁹¹ Foremost among these is a “chain of custody” for both software and the machines.³⁹² Another suggestion is “parallel monitoring” of machines on election day, to make sure that they are properly recording votes as intended.³⁹³ Such testing was actually conducted in counties using DREs in California’s March 2004 election. It revealed that the DRE machines tested recorded votes with 100% accuracy.³⁹⁴ Another key procedural recommendation is that DRE terminals not be connected to a network and certainly not connected to the internet.³⁹⁵

Improved Standards and Testing. Virtually all the studies of DRE security have recommended an overhaul of the process for testing software and hardware. Before enactment of HAVA, the Federal Election Commission was responsible for promulgating standards for hardware, software, and other aspects of voting systems. Compliance with the FEC standards is voluntary, but they are followed by 36 states. The testing itself is performed by independent testing agencies (or “ITAs”), private companies that contract with election authorities at the state and local level.³⁹⁶ Critics have argued that both testing standards and the closed-door process by which

---

³⁹¹California Secretary of State Kevin Shelley, *supra* note 156, 339, at 9-10; SAIC, *supra* note 329; RABA, *supra* note 346.

³⁹²Shamos, *supra* note 325, §3.3.1.

³⁹³*Id.* § 3.5.

³⁹⁴California Report.

³⁹⁵SAIC, *supra* note 65, at 9; Secretary of State Kevin Shelley, *supra* note 26, 67, at 35.

³⁹⁶Shamos, *supra* note 325, §1.3.

testing is conducted leaves much to be desired.³⁹⁷ HAVA requires changes in the process for developing standards, through the EAC and related entities.³⁹⁸ But due to the delays in establishing the EAC, and Congress' failure to appropriate the full amount authorized for its budget, it is unclear whether new standards and guidelines will be in place by January 2006, the effective date of HAVA's voting system standards.³⁹⁹

Cryptography. An alternative to the CPR that might better achieve the goals of accessibility and transparency is to create an independent audit channel for electronically cast votes. Supporters of this method argue that it provides for greater transparency and better auditability than the CPR.⁴⁰⁰ Under one model, the voter would receive a piece of paper at the time of voting. Instead of displaying the names of the candidates chosen, the receipt would contain encrypted information. Afterwards, each voter could determine if his or her vote was counted as intended, by comparing the receipt to information posted on the internet. In theory, this would provide a form of "voter verifiability," without the difficulties inherent in printing paper ballots.⁴⁰¹ In contrast to the CPR, which can only confirm that the vote was correctly *captured* by the DRE,⁴⁰² this type of encrypted technology would (at least in theory) allow voters to determine whether their votes were correctly *counted*.

Paperless Audit Trails. While the CPR is one means of achieving a "voter verifiable" audit trail, it may not be the only one. Put another way, voter verifiability is not synonymous with *paper* ballot replicas. Indeed, the California touchscreen task force recommended that a voter verifiable *audit* trail be required for all DREs purchased after 2007, even though a majority wisely declined to recommend imposition of a requirement that this audit trail be paper-based.⁴⁰³ One proposal is for is that an *audio* audit trail be developed. Under this proposal, a voter would actually listen to his or her choices at the conclusion of the voting process, and a tape recording made of those choices.⁴⁰⁴ Such voter verified audio

---

³⁹⁷Fisher, *supra* note 24, at 25.

³⁹⁸42 U.S.C. §15371.

³⁹⁹Fisher, *DREs*, *supra* note 24, at 24.

⁴⁰⁰Fisher, *DREs*, *supra* note 24, at 30.

⁴⁰¹The technology described is the VHTi, marketed by VoteHere. Information regarding this technology is available at www.votehere.net.

⁴⁰²See Shamos, *supra* note 325, §2.4.

⁴⁰³Secretary of State Kevin Shelley, *supra* note 156, 339, at 43-44.

⁴⁰⁴Selker & Goler, *supra* note 374.

transcripts would have the added advantage of allowing visually impaired and illiterate voters to verify their choices. Another proposal is the “votometer,” a separate electronic device attached to the DRE, that would record and display voters’ choices. The votometer records could be tallied separately, to avoid any possible collusion.⁴⁰⁵

Open Source. Another promising proposal for promoting both security and transparency in the long term is the development of voting technology that uses open-source software.⁴⁰⁶ The software used would be open to public scrutiny which, in theory, would allow interested members of the public to inspect it for flaws. Until now, voting equipment vendors have claimed that their software is a trade secret and they have guarded against any attempts to make their source code publicly available.⁴⁰⁷ Thus, the code is now disclosed only to ITA’s and other selected parties under nondisclosure agreements.⁴⁰⁸ Vendors have also argued that keeping source code secret provides security advantages, by limiting the number of people who can exploit any potential vulnerabilities. Others have criticized the “security through obscurity” approach, arguing that such stringent limitations on access to source code severely diminishes the opportunity to expose vulnerabilities or malfeasance.⁴⁰⁹ While none of the major vendors are currently marketing open source products, a group called the “Open Voting Consortium” is developing an open source voting system.⁴¹⁰

****

All of these proposed reforms have the potential to address the vulnerabilities of DRE technology. My point in describing them, however, is not to suggest that any of them are a magic bullet. At this point, it cannot be said with confidence that any of them will be sufficient to fix the vulnerabilities that have been identified. Some of the measures described above may prove superior to the CPR; others may turn out to present similar or even greater difficulties. It is even possible that the questions regarding the workability and efficacy of the CPR may ultimately be resolved. It is too soon to say whether any

---

⁴⁰⁵*Id.*; see also Fisher, *supra* note 24, at 29.

⁴⁰⁶Clive Thompson, *A Really Open Election*, N.Y. TIMES, May 30, 2004, §6, at 14.

⁴⁰⁷Shamos, *supra* note 325, §3.1.

⁴⁰⁸Fisher, *supra* note 24, at 26.

⁴⁰⁹*Id.*

⁴¹⁰Information regarding the Open Voting Consortium may be found at <http://www.openvotingconsortium.org/>.

of the above options, either alone or in combination, will prove workable or effective.

Considerable uncertainty thus remains on how best to promote the democratic values of equality, security and transparency, when it comes to the implementation of electronic voting technology. The question to which I now turn is how the various public institutions with responsibility for safeguarding these values should proceed, in light of this uncertainty.

IV. BUILDING BETTER VOTING SYSTEMS

The competing democratic values identified in parts II and III create a conundrum. On one hand, there is considerable evidence that implementation of electronic voting technology can promote the core equality values of racial equality, disability access, multilanguage access, and inter-jurisdictional equality. On the other hand, there are legitimate concerns about the election systems relying on present-generation DRE technology, when it comes to both security and transparency. And there are serious reasons for doubting that a contemporaneous paper record provides either a workable or an effective solution to these problems. It is unlikely that the perfect voting technology – one that ensures equality while providing airtight security and transparency – will come along any time in the immediate future. Given the developing state of voting technology, no one can plausibly claim to have any single solution to this conundrum.

All of this may seem like an insoluble mess. But it may also be viewed as an opportunity. Existing paper-based voting technology is not perfect. Neither are existing DREs, despite the significant advantages that they offer in terms of racial equality, disability accommodation, and multilingual access. The challenge is to find a way to encourage innovation, while at the same time safeguarding the basic equality rights protected by law. It is not only, and in fact not primarily, the courts that face this challenge. It is also a challenge that Congress, state legislative bodies, and administrative agencies (foremost among them the EAC) must meet in the coming months and years. Most important of all, it is a challenge that faces election officials in each of the 50 states, and the thousands of local entities with responsibility over our election systems.

Some have decried the “fragmented” character of our election systems, under which authority is dispersed to thousands of local and states entities.⁴¹¹ Yet the decentralized character of our elections

⁴¹¹Pastor, *supra* note 6, at 585.

systems provides an opportunity to innovate, while limiting the costs of that innovation. To be sure, experimentation in the context of election administration must be undertaken with the utmost care, given that the fundamental character of the right to vote. At the same time, the unanswered questions that remain about the voting technologies now being used – and ones that will come into use in the coming months and years – make it inevitable that some further experimentation will take place. The State of California, for example, became the first to employ parallel testing on a statewide basis in the March 2004 election.⁴¹² And Nevada is experimenting with the CPR in its 2004 elections.⁴¹³

The challenge for the judiciary, legislatures, and other institutions is how to encourage innovation and experimentation, while at the same time safeguarding the basic equality rights protected by the Constitution and other voting rights laws. What follows instead is a set of recommendations on how the courts, legislative and administrative bodies, and election officials can best further the several democratic values implicated by the introduction of new voting technology.

A. The Judiciary

I have already discussed three types of legal challenges to voting equipment. The first type is exemplified by the ACLU lawsuits, challenging the use of punch card and other paper-based voting equipment under the Equal Protection Clause and Voting Rights Act.⁴¹⁴ The second are lawsuits challenging the use of DRE equipment, on the ground that it violates the Fourteenth Amendment or state law by failing to provide a paper record that can be used in the event of manual audits.⁴¹⁵ The third type consists of lawsuits brought under the Americans with Disabilities Act and other civil rights laws, challenging the failure to provide voting technology (specifically DREs) allowing people with disabilities to cast secret and independent ballots.⁴¹⁶ Lawsuits of each type remain pending in state and federal courts around the country.

---

⁴¹²Kevin Shelley, California Secretary of State, *Report on the March 2, 2004 Statewide Primary Election* (Apr. 20, 2004).

⁴¹³Kim Zetter, *E-Vote Printers High-Stakes Test*, WIRED NEWS, May 27, 2004.

⁴¹⁴*Supra* notes 100 and 101.

⁴¹⁵*See supra* note 9 and accompanying text.

⁴¹⁶*See supra* note .

Each type of case implicates the basic democratic values that I identified in Part II. The ACLU and disability rights cases both implicate the core political value of political equality – and more specifically, the norms of racial equality, disability access, and inter-jurisdictional equality. The challenge to DRE voting technology implicates the values identified in Part III, with plaintiffs in those cases arguing that the use of equipment lacking a “paper trail” compromises security and integrity.

Rick Hasen has persuasively argued that the role of the Supreme Court, when it comes to constitutional voting rights cases is to protect “core equality principles.”⁴¹⁷ Outside of those core areas, he urges court to tread carefully, and avoid constitutionalizing contested political rights. While my focus here is on both constitutional and statutory voting rights, I agree that courts have a responsibility to safeguard core equality norms. Foremost among those are the four that I identified in Part II. Embodied in both federal voting rights statute and the Constitution, these norms are designed to prevent the government from tilting the political playing field to the disadvantage of certain groups. Because they bear upon the right of citizens to participate as equals in the conversations of democracy, these norms have a foundation in the First Amendment as well as the Fourteenth. They are an integral part of what I have labelled “First Amendment Equal Protection,” an area in which courts have traditionally – and for good reason – been especially jealous in guarding against threatened inequalities.⁴¹⁸

For this reason, courts should not hesitate to intervene when the state’s deployment of certain voting equipment threatens to undermine core equality norms, such as racial equality or disability access. On the other hand, they should be more cautious in proceeding where no such equality norms are implicated. Moreover, even where core equality norms are implicated, courts should exercise restraint in determining the appropriate *remedy* for the voting rights violation at issue. Given the uncertain state of voting technology, it would be a mistake for courts to require the implementation of any specific type of equipment or security fix.

Recent litigation within each of the three types noted above illustrates the proper judicial approach to voting technology. *Common Cause v. Jones* and *Black v. McGuffage* implicated the core equality norms of racial equality and inter-jurisdictional equality – more specifically, the idea that voters should not be denied an equal opportunity to have their votes counted, based on their race or where

---

⁴¹⁷HASEN, *supra* note 13, at 74.

⁴¹⁸See generally Tokaji, *First Amendment Equal Protection*, *supra* note 11.

they live. In both of these cases, the courts acted properly in affirming these norms and recognizing their applicability to the voting technology used.⁴¹⁹ Yet these decisions both exemplify an admirable restraint. They do not demand uniformity of equipment. Instead, they characterize the equal protection violation as “whether a state may allow the use of different types of voting equipment with *substantially* different levels of accuracy.”⁴²⁰ This standard allows states to experiment with different types of voting equipment, while protecting the core of political equality.

In this respect, the equality standard set forth in *Black* bears comparison to the standard that the Supreme Court has set in its one person, one vote cases decided under the Fourteenth Amendment. This standard requires that electoral districts be of roughly equal size, while allowing “minor deviations” from precise numerical equality.⁴²¹ So too, courts in voting technology cases should not require that voting technology used throughout the state yield precisely the same results – either across districts or among people of different races – a standard that would be practically impossible to meet. The better standard is instead that articulated in *Black*, which forbids the use of voting technologies with *substantially* different levels of accuracy, while allowing minimal deviations from precise equality.

For similar reasons, the *Common Cause* court showed commendable restraint when it came to the remedy imposed. The court did not require that California implement any particular form of voting technology statewide. Instead, the court decertified the equipment that was alleged to contravene equality norms (namely, Votomatic-style punch cards), while leaving it to the state and counties to fashion a remedy. In particular, the court made a determination as to *when* the unreliable equipment could feasibly be replaced, but allowed that equipment to be replaced by any certified voting technology – either electronic or paper-based.⁴²²

On the other hand, the Ninth Circuit’s en banc opinion in the California recall case, *Southwest Voter Registration Education Project v. Shelley*⁴²³ is a disappointment, even if one agrees with its

---

⁴¹⁹*Common Cause v. Jones*, 213 F. Supp. 2d 1106 (C.D. Cal. 2001); *Black v. McGuffage*, 209 F. Supp. 2d 889 (N.D. Ill. 2002).

⁴²⁰*Id.* at 898.

⁴²¹*Brown v. Thompson*, 462 U.S. 835, 842-43 (1983).

⁴²²The parties in *Common Cause* stipulated that the equipment challenged – in that case, Votomatic-style punch cards – should be decertified and left it to the court to determine the date by which it was feasible to replace the decertified equipment. 213 F. Supp. 2d 1110 (C.D. Cal. 2002).

⁴²³344 F.3d 914 (9th Cir. 2003).

result. The en banc court affirmed the denial of the preliminary injunction postponing the California recall, pending the replacement of punch cards. This opinion followed a three-judge panel's opinion concluding that the use of punch cards in some but not all California counties denied equal protection. The three-judge panel had engaged in a thorough discussion of the equal protection merits.⁴²⁴ By contrast, the en banc court issued a brief opinion that dodged the issue, stating that it was one on which reasonable jurists might disagree while declining to specify the standard according to which the claim should be judged. Instead, the en banc opinion relied on the deferential standard traditionally accorded preliminary injunctions and the harm to state that would result from postponing the recall.

The reluctance to postpone an election that has already begun is understandable. The en banc court dropped the ball, however, by failing to provide clear guidance on the important constitutional and statutory voting rights issues raised. Both these claims implicated core equality norms. A better approach would have been for the court to have ruled definitively on the Fourteenth Amendment and Voting Rights Act claims, and then proceeded to weigh the seriousness of those violations against the hardship to the state that would arise from issuance of the requested relief – as the preliminary injunction standard allows. Even if the result had been the same, addressing the merits would have provided guidance to future courts on the scope and applicability of the equality norms in question.

More impressive is the decision in *Weber v. Shelley*, another Ninth Circuit case. *Weber* was a type two case, in which the plaintiff challenged the use of paperless DREs. As the court properly noted, every voting regulation will have some impact on the right to vote. Only those that impose “severe” restrictions on the right to vote, as opposed to “reasonable, nondiscriminatory” restrictions, should be subject to heightened scrutiny. In contrast to such cases as *Common Cause* and *Black*, for example, the plaintiff had come forward with no evidence showing that citizens using a particular type of equipment are less likely to have their votes counted. There was, for example, no evidence that Riverside County's use of DREs resulted in their voters being less likely to have their votes counted, nor was there any evidence that it generated a racial disparity. To the contrary, the evidence available shows that the present generation of DREs are *more* likely to record votes accurately than other types of equipment and that they can significantly reduce the racial gap in uncounted votes. In short, the *Weber* court acted correctly, given the plaintiffs' failure to demonstrate that the voting technology in question violated

---

⁴²⁴344 F.3d 882 (9th Cir. 2003).

any core equality norm.⁴²⁵

Type three cases, challenging the failure to implement DRE voting equipment, bring to the fore the core equality norm of disability access. The ability to cast a secret and independent ballot on an equal basis as other citizens is integral to the right to vote,⁴²⁶ and courts should enforce this equality norm. It is appropriate to require that DREs be made available to people with disabilities. On the other hand, courts should exercise caution when it comes to remedy. The best course of action is to make at least one DRE unit available for citizens with disabilities at each polling place (as HAVA will require effective 2006), while leaving it up to counties to determine whether to institute DRE technology for able-bodied voters. This will protect disabled citizens' right to a secret and independent ballot, without unduly intruding into state and county election officials' authority to safeguard other democratic values in the voting process.

In sum, courts considering legal challenges to voting technology should focus on whether the challenged system contravenes a core equality norm. If it does, then they should not hesitate to declare that the use of that system contravenes equality norms embodied in both the Constitution and voting rights statutes. But in crafting remedies, courts should exercise restraint in order to ensure that election officials retain the authority needed to serve the democratic values of equality, security and transparency.⁴²⁷

---

⁴²⁵A recent state court decision from Maryland likewise illustrates the propriety or restraint in type two voting technology cases. Although based on state rather than federal law, *Schade v. Maryland State Board of Elections* raises issues similar to those implicated by Weber. Plaintiffs argued that the Diebold DRE system used in Maryland failed to protect the security of the voting process and failed to count votes accurately. After reviewing the expert evidence submitted by both sides, the circuit court declined to grant a preliminary injunction. It found that "the use of paper ballots is the least accurate of all systems and lends itself to the most chicanery," while DREs "if untampered ... are the most accurate in recording and counting votes." It also recognizes the accessibility advantages of DREs, pointing out that they allow blind and visually impaired citizens to vote independently. Most important, the court properly recognizes that no voting technology is perfect – and that imposing a standard of perfection would effectively paralyze government entities attempting to implement the best practicable voting equipment. Applying the preliminary injunction standard, the court finds that the "hypothetical harm" to plaintiffs arising from the use of punch cards doesn't outweigh the "real harm" to the state that would arise from having to implement a parallel paper system at this late date. Order denying preliminary injunction, Sep. 1, 2004, slip op. at 2

⁴²⁶See generally, Waterstone, *supra* note 195.

⁴²⁷My focus here is solely on federal law arguments, not on state-law based claims that might be made against different voting technologies.

B. Legislative and Administrative Bodies

If the role of the courts is to protect the core equality norms, then the role of the legislative branch might best be described as providing a structure that will *promote* all three of the democratic values I have identified. In exercising this responsibility, it is imperative that legislative bodies, like the courts, proceed with caution. Given the unanswered questions that remain about how best to secure voting technology, it is a serious mistake to insist upon legislation mandating any particular technological fix, such as the VVPAT. That would lock states into a remedy that has yet to prove workable or effective. Instead, Congress and state legislatures should work within the structure provided by the Help America Vote Act. That means providing funding for research and for experimentation by state and local entities.

Most of the post-HAVA legislative discussion has focused on whether to require that electronic voting units generate a contemporaneous paper replica. In Congress and several states, legislation has been introduced to require a “voter verified paper audit trail.” In both the House and the Senate, legislation has been introduced to require such an audit trail nationwide. The centerpiece of these efforts is H.R. 2239, sponsored by Rep. Rush Holt.

Enactment of this legislation would do more harm than good. As a practical matter, the CPR required by H.R. 2239 would do little to enhance election security. It is also unclear whether it is practically feasible for voting machines to produce a contemporaneous paper replica that the voter can see but not touch. To enact this legislation at this stage, moreover, would place states and counties that have not already upgraded their voting technology in a bind. The states that received money under Title I of HAVA are required to either replace their punch card and lever voting equipment by 2006, or forfeit those funds. It would also complicate the requirement that each polling place have at least one disability accessible unit by 2006.⁴²⁸ Given the unanswered questions regarding the CPR, the foreseeable consequence of bill like H.R. 2239 is to discourage counties from moving to electronic voting technology at all.⁴²⁹

Worse still, H.R. 2239 would stifle innovation. Manufacturers forced to tailor their voting equipment to meet this requirement would forego other potential means of enhancing security. This would be unfortunate, as many of these show much

---

⁴²⁸ 42 U.S.C. § 15481(a)(3).

⁴²⁹ As explained *supra* III.B.2, a DRE with a contemporaneous paper record have been used on a limited basis, in elections in California and Connecticut.

greater promise than the CPR.⁴³⁰

Legislation mandating a CPR at the *state* level can be expected to have some of the same deleterious effects as H.R. 2239. The Ohio legislature, for example, enacted a bill to require the CPR effective 2006 (H.B. 262). The consequence of that bill was for all of Ohio's punch card counties to stick with that equipment in the 2004 election. With this requirement looming on the horizon, and uncertainty about whether existing DRE technology could be retrofitted to meet the CPR requirement, all of the state's remaining punch card counties decided to stand pat.⁴³¹ Whatever the risks of electronic voting, it can scarcely be contested that the Votomatic-style punch card ballot is an outmoded method of voting that ought to be replaced.

While precinct-count optical scan equipment presents a possible alternative, the implementation of this technology requires staff and poll worker resources that are simply unavailable to many urban jurisdictions. As a practical matter, then, the choice that such legislation imposes is to either (1) implement a DRE system capable of generating a contemporaneous paper replica, despite the fact that this equipment has yet to prove either workable or effective, or (2) stick with the punch card and forfeit monies that have already been provided under Title I of HAVA. If election officials are put to this Hobson's Choice, the big losers will be those whose voting rights have most often been denied: people of color, disabled voters, and language minorities. For it is these voters who have the most to gain from implementation of DRE systems.

From the perspective of disability and language access, a CPR mandate raises especially glaring concerns. The California attorney general's office has taken the position that imposition of such a requirement would violate the ADA, given the absence of any means by which blind and visually impaired voters could "verify" that the choices on a printed ballot are accurate.⁴³² Although two companies are currently marketing CPR systems that they claim to be accessible, this equipment has yet to be tested in a real election of any significant

---

⁴³⁰Potential alternative means are discussed in the California Secretary of State's Ad Hoc Touch Screen Task Force Report, July 1, 2003. That task force, as discussed below, accepted the recommendation that an audit trail be required, but rejected the suggestion that a paper record is the only type of acceptable audit trail.

⁴³¹John McCarthy, *Electronic Voting on Hold*, CINCINNATI ENQUIRER, July 17, 2004.

⁴³²See Letter from California Attorney General to Randy Riddle, Chief Counsel, Secretary of State, July 28, 2003.

size.⁴³³ And in the only statewide experiment with the CPR, Nevada's 2004 election, the equipment being used is unable to print paper replicas in languages other than English. As a result, voters in the one Nevada county that is required to make voting materials available in both English and Spanish (Clark County) will be using DRE units that do *not* print out paper ballot replicas.⁴³⁴

Instead of rushing to enact unproven solutions, Congress and state legislatures should work within the basic structure provided by HAVA. Although HAVA was enacted before the controversy over DRE voting exploded into the public consciousness, Congress was aware of the security and transparency issues surrounding electronic voting. Not only did HAVA require a paper record with a manual audit capacity, but it also created the Election Assistance Commission to serve as a national clearinghouse for compiling information on voting systems.⁴³⁵ To assist in the EAC's efforts, the legislation also created a standards board, a board of advisors and a technical guidelines development committee.⁴³⁶ It also provides for the EAC to overhaul the standards and process for certifying voting equipment.⁴³⁷ Perhaps important, it provides for the EAC to conduct research on how best to promote secure electronic voting.⁴³⁸

The EAC has now posted on its website "best practices" for different types of voting equipment.⁴³⁹ While this is a start, there is much more that the EAC can do – and must do under HAVA – to promote secure, transparent, and accurate electronic voting. Unfortunately, the ability of the EAC to undertake its important responsibilities has been stymied by the late appointment of the four commissioners and the failure to provide the commission with full funding.⁴⁴⁰ For the EAC to do its work adequately, it is imperative that Congress provide it with full funding.

---

⁴³³Those two companies are Avante and AccuPoll. See <http://www.accupoll.com/TheAccuPollAdvantage/>; <http://www.aitechnology.com/votetrakker2/papers.html>.

⁴³⁴Erica Werner, *Nevadans Get Look at New Voting Machines*, RENO GAZETTE-JOURNAL, Jul. 17, 2004.

⁴³⁵42 U.S.C. § 15322.

⁴³⁶42 U.S.C. §§ 15343, 15344, 15361.

⁴³⁷42 U.S.C. § 15371.

⁴³⁸42 U.S.C. § 15385.

⁴³⁹www.eac.gov.

⁴⁴⁰BNA Money & Politics Report, *New Commission Sees Extreme Difficulty in Future Operation Due to Budget Woes*, Sept. 14, 2004, available at <http://pubs.bna.com/ip/BNA/mpr.nsf/is/A0A9Q7Y1J0>.

More broadly, it is essential that both Congress and the state legislatures alter their perspective on election reform. For far too long, the decrepit condition of our democracy's infrastructure was neglected. Rather than viewing the replacement of voting equipment as a generational occurrence, to take place only when the harsh light of public scrutiny forces alternation, legislative bodies must look upon the refurbishment of voting technology as an ongoing responsibility. This may require more resources, in addition to the \$3 billion in federal funding authorized for fiscal years 2003 through 2005. As technology continues to evolve, voting systems must continue to adapt to those changes.

C. State and Local Election Officials

Primary responsibility for implementing new voting technology rests not with the courts, legislatures, or the EAC. For better or for worse, that authority lies in the hands of secretaries of state, boards of election, and county registrars throughout the country. Responsibility for implementing HAVA's charge of making our election systems more secure and more equal lies largely in their hands.

While some commentators have decried the decentralization of our election system,⁴⁴¹ this decentralization provides an opportunity. Within most states, authority for determining what type of voting technology to use rests with county registrars. Vesting this authority in local rather than state officials serves some useful purposes. Certain types of voting equipment may be appropriate for some jurisdictions but inappropriate for others. For example, a precinct-count optical scan voting system may work well in a smaller county with few language minorities and plentiful poll worker resources. That system may work poorly, however, in understaffed urban jurisdictions. In addition, the decentralized character of our election system allows for counties and townships to serve as true laboratories of democracy. They may experiment with different types of voting equipment, and different means of enhancing security – such as the CPR, non-paper audit trails, and perhaps even open source equipment.

On the other hand, there is a strong argument to be made for statewide uniformity of voting technology. Adoption of one type of voting equipment throughout a state can avoid the equal protection problems, arising from the use of substantially less accurate

⁴⁴¹See Pastor, *supra* note 16.

technology in some jurisdictions.⁴⁴² It can ensure that citizens are not disfavored by the happenstance of where they reside. Moreover, mandating a particular type of equipment, such as DREs, can help promote equality by ensuring that citizens throughout the state have access to the best available voting equipment.

Two states (Maryland and Georgia) have now implemented the same type of DRE technology throughout the state.⁴⁴³ The chief benefit of the statewide approach is that it promotes uniform treatment of voters throughout the state. The downside is that it risks catastrophe, if the voting system chosen fails to perform as advertised. Maryland and Georgia have endured some criticism for moving too quickly, although the technology they selected appears to have performed well thus far. Whether Nevada's statewide experiment with a CPR system will prove equally successful remains to be seen.

In the end, there is no clear answer to the question whether states should implement uniform technology, or instead allow counties to experiment with different types of equipment. What is clear is that, in the process of upgrading technology, some mistakes will inevitably be made. When those mistakes are made, it is imperative that state and federal legislative bodies step in to provide funding to allow those mistakes to be corrected – rather than allowing election officials to muddle through with bad technology. Improving our election systems requires accepting the fact that some mistakes will be made along the way, and committing ourselves to righting those mistakes when they occur.

IV. CONCLUSION

Electronic voting has the potential to reduce the number of lost votes, while effecting substantial improvements in racial equality, disability access, and multilingual access. At the same time, the implementation of this technology poses serious risks, if unaccompanied by appropriate procedural safeguards.

There are also legitimate concerns about the transparency of present-generation DRE technology. But in focusing myopically on the "paper trail," the public debate has lost sight of the core democratic values that should inform the comparison of different voting technologies. In turning paper into the gold standard, the debate has largely ignored the interests of minority, disabled, and non-English proficient voters who stand to benefit from

---

⁴⁴²See *supra* part II.A.4.

⁴⁴³See *supra* part I.B.4.

implementation of DRE technology. It has completely failed to engage in any comparative analysis of currently available voting systems. And has disregarded the practical difficulties of attaching printers to DREs, while exaggerating the benefits that would derive from mandating a contemporaneous paper record.

There is a better way. State-commissioned studies of electronic voting have already suggested several available means by which DRE security should be improved without jeopardizing the tremendous benefits that voters stand to gain from DREs. Non-governmental entities are pursuing other promising alternatives, such as open source code and encrypted ballots. We need not sacrifice the voting rights of people of color, disabled voters and non-English speaking citizens in order to achieve the admirable goal of enhancing election security and transparency.

The courts and legislative bodies have an essential role to play in promoting these democratic values. Courts should guard the norms of racial equality, disability access, multilingual access, and inter-jurisdictional equality. At the same time, they should exercise caution in fashioning remedies, rather than mandating the implementation of any particular technology for all voters statewide. Legislatures should likewise allow state and local officials flexibility. It is a mistake to write into stone any particular security fix – such as the “voter verified paper audit trail” – until it has proven workable, effective, and superior to other methods. Such legislation can only stifle innovation, while doing little to promote secure and transparent elections.

While the courts and legislative bodies have an important role to play in the process of transforming our voting technology, the most important responsibilities lie in the hands of state and local election officials. This is an inevitable consequence of the decentralized character of our election administration systems. But it is also an approach that provides significant advantages, allowing for innovation while limiting the consequences of the mistakes that inevitably will be made.

The Help America Vote Act is a start – but it is only a start. Better technology can mean more secure, transparent, accessible, and equal voting systems, but only if Congress and state legislative bodies provide the funding and oversight to make that possibility a reality. If we are to promote the democratic values of equality, security and transparency, we must stop looking at election reform as a destination, and instead view it as an ongoing process that will continue long for as long as better voting technologies continue to emerge.

Appendix A - Summary of State HAVA Plans

The chart below summarizes the 50 states' Help America Vote Act implementation plans, in the area of voting equipment. The column labelled "current" indicates the type of equipment used at the time of the HAVA plan's submission, while the chart labelled "proposed" indicates the type of equipment to which the state planned to convert. The last column indicates the amount, either in dollars or the percentage of HAVA payments received, that the state planned to devote toward new voting equipment.

State	Current	Proposed	Amount
Alabama	53 counties (precinct-level tabulation optical scan); 10 (central tabulation optical scan); 3 DRE; 1 lever machine; never used punch cards	Replace mechanical lever voting machines in Bullock county; replace or modify voting machines in Mobile, Montgomery, and DeKalb counties; replace centralized ballot counting systems in 9 counties; DRE requirement	\$23,000,000 allocated
Alaska	163 precincts (hand count paper ballots); 283 (optical scan paper ballots [Accu-Vote OS 2000]); no DREs	Continue to expand the use of the optical scan voting system in hand count precincts; DRE requirement	\$4,500,000 allocated
Arizona	9 counties (punch cards); 6 counties (no info)	Replace punch card voting systems in 9 counties; DRE requirement	Approximately 56% of funds
Arkansas	5 counties (DREs); 46 (central tabulation optical scan); 3 (precinct-level optical scan); 8 (hand count paper ballots); 13 (lever machines or punch cards)	Replace lever machines or punch card systems with DREs; replace all systems with DRE if federal funding sufficient	\$12,000,000-20,000,000 estimated, depending on federal funds
California	3 categories of systems: optical scan, DRE/touchscreen, punch card	Replace punch card voting systems; DRE requirement; consider decertifying paper-based systems	Funds from HAVA as well as up to \$200,000,000 in general obligation bonds authorized by the state; funds to be allocated by Secretary of State

Colorado	Systems: paper ballots, central count optical scan, precinct count optical scan, punch card; only 1 county continues to utilize punch cards, but will probably opt for another voting system	Already meets/will meet requirements; DRE requirement	\$10,100,000 allocated
Connecticut	3 municipalities (optical scan); 166 (lever machines)	Actively considering upgrading lever machines; replacement of all lever machines delayed by insufficient federal funding; DRE requirement	\$20,500,000 estimated
Delaware	DREs [ELECTronic 1242 (model 6T)]	Replaced punch card and lever machine in 1996 with DREs; DRE requirement (DREs that meet accessibility requirement)	\$5,700,000 estimated
Florida	Already replaced punch cards, lever machines, paper ballots, and central count optical scan systems with precinct tabulated Marksense voting systems or DREs; 15 counties (DREs); 52 (precinct level optical scan)	DRE requirement	\$11,740,000 from Sec. 102 for punch-card buyouts (\$24 million was spent by state), \$11,600,000 expected to be spent on DREs
Georgia	159 counties (DREs [Diebold])	Meets all requirements, including DRE requirement	Funds already expended, \$53,900,000, to replace voting systems
Hawaii	All precincts use precinct level optical scan [ES&S Model 100])	DRE requirement	Approximately 8,000,000 allocated
Idaho	16 counties (paper ballot); 14 (optical scan); 14 (punch card)	Provide excess funds on optional grant program to upgrade systems; DRE requirement	No info

Illinois	90 counties (punch card); 2 (precinct-level punch card [PBC 2100]); 10 (precinct level optical scan [Accu-Vote]); 3 (precinct level optical scan [Optical Scan M100]); 3 (Marksense Optech IV-C); 2 (Marksense Optech III-PE)	Replace punch cards; voter education if counties decide to retain central count systems; DRE requirement	\$42,000,000 allocated
Indiana	32 counties (punch card and lever machine); 60 counties (other systems)	Replace punch cards and lever machines; DRE requirement	Will set aside \$39,200,000 to reimburse counties
Iowa	6 counties (lever machines); 1 (paper ballots); 59 (central count optical scan); 18 (precinct count optical scan); 15 (DRE)	Replace lever machines; DRE requirement	\$42,000,000 estimated
Kansas	81 counties (optical scan); 21 (hand count paper ballots); 3 (DRE); punch card and lever machines are not used	Voter education to make paper ballot and central count optical scan systems compliant; DRE requirement	No info
Kentucky	96 counties (ELECTronic 1242 DRE); 17 (MicroVote MV-464 DRE); 1 (ACCU-VOTE ES Optical Scan Tabulation); 1 (lever machines); 5 (mechanical lever machines and MicroVote MV-464)	Replace lever machines; DRE requirement	Approximately \$18,200,000 estimated
Louisiana	50 parishes (AVM-POM lever machines); 14 (electronic voting machines [AVC Advantage and iVotronic])	Replace lever machines; DRE requirement	Estimated 91.8% of federal funds received
Maine	394 municipalities (hand counted paper ballots); 109 municipalities (precinct level optical scan ballots [Accu-Vote ES-2000 (36 municipalities)]; [Optech IIIP (47 municipalities)]; [Optech IIIP Eagle (24 municipalities)]; [ES&S Model 100 (2 municipalities)])	Modify current machines; DRE requirement	Estimated \$5,000,000-10,000,000

Maryland	4 systems: Optical Scan (ES&S Optech III-P Eagle and Diebold Model ES-2000) and DRE (Diebold AccuVote TS and Sequoia AVC Advantage)	In the process of meeting requirements; DRE requirement	\$57,500,000 allocated
Massachusetts	392 precincts (lever machines); 11 (Datavote systems); 1665 (optical scan [Accu-Vote (1042 precincts), Optech (176 precincts), and Optech Eagle (447 precincts)]); 90 (paper ballots)	Replace lever machines and Datavote machines; DRE requirement	100% of Sec. 102 monies & 15% of Title II monies
Michigan	445 precincts (lever machines); 98 (paper ballots); 866 (central count punch cards); the rest of the 5,405 total precincts use either DRE or precinct level optical scan	Replace punch cards and lever machines; DRE requirement	Estimated \$55,000,000 to be allocated
Minnesota	7 counties (hand count paper ballots); 24 (central count optical scan); 14 (precinct tabulator optical scan); 42 (mixed systems) TABLE AVAILABLE ON SPECIFIC SYSTEMS	Implement a uniform, statewide voting system with locally-owned, precinct-based, optical scan equipment; DRE requirement	No info
Mississippi	8 jurisdictions (lever systems); 11 (punch cards); 1 (Opscan [combination OMR and punch card]); 8 (precinct level optical mark reader systems); 51 (central optical mark reader systems); 1 (DRE); 2 (Shouptronic systems)	Replace all non-DRE voting devices with DREs, if full federal funding	Plans to spend approximately \$15,000,000 in federal funds
Missouri	9 counties (hand count paper ballots); 37 (punch cards); 70 (optical scan)	Replace punch cards; DRE requirement	Unclear
Montana	6 counties (punch cards); 45 (optical scan); 5 (paper ballots)	Replace punch cards in 5 counties (1 county already replaced their system after the 2000 election); DRE requirement	Approximately \$3,100,000 allocated

Nebraska	Two methods: hand counting of paper ballots and central optical scan system for paper ballots (no breakdown by counties)	DRE requirement	Approximately \$5,300,000 allocated
Nevada	7 counties (punch cards); 9 (optical scan); 1 (DRE)	Replace all punch cards and optical scan systems with DREs, if sufficient funding; DRE requirement	Approximately \$8,500,000 allocated
New Hampshire	162 polling places (optical scan [Optech IIIP (39); Accuvote OS ES-2000 (123)]); 147 (hand count paper ballots)	Replaced punch cards in 1986; DRE requirement	25% of available funds to be allocated
New Jersey	7 counties (lever machines); 14 (no info)	Replace lever machines and upgrade other systems; 2 counties replaced punch cards in 2001; DRE requirement	To be determined, estimated \$39,000,000 for complete upgrade
New Mexico	DRE and optical scan (no info on number of counties)	Already replaced punch card and lever machines; begin replacing older systems; DRE requirement	Initial \$5,000,000 in Title II funds to be used for DRE purchases
New York	All 62 counties (lever machines)	Replace lever machines (19,843 systems); DRE requirement	\$140,000,000 total budgeted
North Carolina	8 counties (punch card); 5 (lever machines)	Replace punch card and lever machines; DRE requirement	\$37,200,000 allocated
North Dakota	44 counties (optical scan); 8 (hand count paper ballots); 1 (punch card)	Replace punch card system in Williams county; DRE requirement	Estimated \$5,000,000-6,000,000
Ohio	69 counties (punch cards); 2 (lever machines); 6 (electronic voting devices); 11 (optical scan)	Replace punch card and lever machines, if sufficient funding; DRE requirement	Estimated \$136,000,000
Oklahoma	4 counties (optical scan); No info on other counties	Upgrade current systems; replace all precinct level and central count devices in largest counties; DRE requirement	\$33,400,000 allocated

Oregon	3 counties (punch cards); 33 (optical scan)	Replace punch cards; DRE requirement; additional DREs, if funding available	\$3,550,000 allocated
Pennsylvania	5 counties (paper ballots); 24 (lever machines); 11 (punch cards); 24 (central count optical scan); 8 (DRE)	Replace punch cards and lever machines; upgrade other systems; encourage DREs or, if not DREs, then encourage precinct level optical scan; DRE requirement	Approximately \$23,000,000 under Sec. 102 funds. State will fully reimburse DRE purchases, part for other machines.
Rhode Island	All 39 cities (precinct level optical scan [Optech III-PE])	Replaced entire system in 1998 with optical scan; 2 DREs per precinct	Approximately \$7,000,000 allocated for DRE purchases.
South Carolina	24 counties (DRE); 10 (punch cards); 12 (MarkSense optical scan system)	Replace all machines with a statewide uniform electronic voting system (no info on which system); DRE requirement	\$36,600,000 allocated
South Dakota	Precinct level and central count optical scan; hand count paper ballots, punch cards (no info on number of counties)	Utilize precinct level and central count optical scan ballots, hand count paper ballots, and DREs; DRE requirement	Approximately \$7,700,000 allocated
Tennessee	41 counties (DREs [Electronic Danaher or Microvote]); 11 (optical scan [ESS Central Count and ESS Precinct Count]); 43 (punch cards or lever machines)	Replace punch cards and lever machines; probably upgrade from central count to precinct level optical scan systems; DRE requirement	\$19,500,000 allocated
Texas	90 counties (hand count paper ballot); 150 (optical scan); 14 (punch cards); 3 (lever machines); 4 (DRE)	Replace punch cards and lever machines; DRE requirement	\$31,800,000 allocated
Utah	23 counties (punch cards); 2 (optical scan); 4 (hand count paper ballots)	Replace punch cards with DREs; DRE requirement	\$20,500,000 allocated
Vermont	184 municipalities (hand count paper ballots); 62 (optical scan)	Propose one type of optical scan system; towns will be permitted to continue use of hand count paper ballot; DRE requirement	\$6,650,000 allocated

Virginia	28 precincts (hand count paper ballots); 493 (optical scan); 1065 (lever machines); 275 (punch cards); 416 (DRE)	Replace punch cards and lever machines; DRE requirement	\$33,100,000 allocated
Washington	16 counties (punch cards); 23 (optical scan); 1 (mixed [optical scan and DRE])	Replace punch cards; DRE requirement; note: WA encourages absentee voting/voting by mail	\$15,700,000 allocated
West Virginia	10 counties (hand count paper ballots); 3 (lever machines); 12 (punch cards); 29 (optical scan); 1 (DRE)	Replace punch cards and lever machines; DRE requirement	Estimated \$16,500,000 allocated
Wisconsin	87% of voters (optical scan); 10% (hand count paper ballots); 3% (lever machines); NOTE: also mentions that 3 counties used punch cards in 2000 election	Develop voter education for central count optical scan counties and paper ballots; replace lever machines; reimburse for replacement of punch cards; DRE requirement	\$16,400,000 allocated
Wyoming	3 counties (lever machines); 5 (punch cards); 6 (central count optical scan); 8 (precinct level optical scan); 1 (DRE)	Replace punch cards, central count optical scan systems, lever machines, and the Guardian Electronic 1242 DRE system; DRE requirement	No info
D.C.	142 precincts (Optical scan voting systems [Optech Eagle P III])	Meets requirements; DRE requirement will be met by 2004 [Sequoia Edge DRE]	\$1,700,000 allocated
Puerto Rico	All voters use hand count paper ballots	Probably replace the current system, but no decision	No info

Sources of Information:

- Voting System Information
- Funding Information

Congressional Record/State Web Sites

http://www.civilrights.org/issues/voting/hava_chart.pdf

Appendix B - Summary of State Recount Laws

The chart below summarizes the recount laws of the 50 states. They are broken down into four categories: (1) automatic - recounts that take place automatically, regardless of the margin of victory, (2) candidate initiated - recounts that may be requested by a candidate, (3) voter initiated - recounts may be requested by voter, (4) close election - recounts take place if the margin of victory falls beneath a prescribed numerical threshold.

State	Type of Recount Provided for by Law				Description of State Recount Laws
	Automatic	Candidate Initiated	Voter Initiated	Close Election	
Alabama				✓	When a candidate is defeated by no more than one half of one percent of the votes cast for the office, a recount will occur unless the candidate submits a written waiver.
Alaska		✓	✓		A defeated candidate or 10 qualified voters may file an application within 5 days after the completion of the state review for a recount of the votes for any particular office.
Arizona				✓	A recount is required when the margin between the 2 candidates receiving the greatest number of votes for a particular office is less than or equal to the lesser of the following: 1) one-tenth of one percent of the number of votes cast for both such candidates 2) 200 votes in the case of an office to be filled by state electors and for which the total number of votes cast is more than 25,000 3) 50 votes in the case of an office to be filled by state electors and for which the total number of votes cast is 25,000 or less 4) 50 votes in the case of a member of the legislature 5) 10 votes in the case of an office to be filled by the electors of city, town, county or subdivision thereof.
Arkansas		✓			Any candidate voted for who may be dissatisfied with the returns from any precinct may petition for a recount of the votes cast therein.

California	✓		✓		During the official canvass of every election in which a voting system is used, the official conducting the election shall conduct a public manual tally of the ballots tabulated by those devices cast in one percent of the precincts chosen at random by the elections official. In addition, voters may file requests seeking a recount of the ballots.
Colorado		✓		✓	A recount of any election contest shall be held if the difference between the highest number of votes cast and the next highest number of votes cast is less than or equal to one half of one percent of the highest vote cast in that election contest. Whenever a recount is not required and interested party (including a candidate who lost the election) may submit a notarized written request for a recount.
Connecticut				✓	When the plurality of an elected candidate for an office over the vote for a defeated candidate receiving the next highest number of votes is either 1) less than a vote equivalent to one-half of one percent of the total number of votes cast for the office but not more than 2,000 votes or 2) less than 20 votes, there shall be a recanvass of the returns unless the defeated candidate submits a written waiver.
Delaware		✓			Any candidate for a statewide office in a general election may apply for a recount if the number of votes separating such candidate and the closest opposing candidate is less than 1,000 votes or less than one half of one percent of all votes cast for the two candidates, whichever is less.
Florida				✓	If a candidate for any office is defeated by one-half of one percent or less of the votes cast for such office the board responsible for certifying the results of the vote shall order a recount of the votes cast with respect to such office.

Georgia		✓	✓		A defeated candidate may petition for a recount if the difference between the number of votes cast for the candidate who has been declared elected and number of votes cast for a candidate not declared elected is not more than one percent of the total votes cast for the particular office in question. In addition, if it appears that there is a discrepancy in the returns recorded, either a defeated candidate or three electors of any precinct (where voting machines have been used) may petition for a recanvass of the votes.
Hawaii					None found.
Idaho		✓			A defeated candidate for election to a federal, state or county office may submit a written request for a recount of the votes cast when the difference between the vote cast for that candidate and for the winning candidate is less than or equal to one-tenth of one percent of the total votes cast for that office. Moreover, any candidate for federal, state or county office may request a recount within 20 days of the canvass of such election.
Illinois		✓	✓		A defeated candidate for election to a federal, state or county office may submit a written request for a recount of the votes cast when the difference between the vote cast for that candidate and for the winning candidate is less than or equal to one-tenth of one percent of the total votes cast for that office. Moreover, any candidate for federal, state or county office may request a recount within 20 days of the canvass of such election.
Indiana		✓			A defeated candidate may file a verified petition for a recount with the election division.
Iowa		✓			The board of canvassers shall order a recount if a written request is made by a candidate or any other person who received votes for the particular office in the precinct where the recount is requested not later than 5 pm on the third day following the canvass of the election in question.

Kansas		✓	✓		Any candidate may request the recount of ballots cast in all or only in specified voting areas for the office for which such person is a candidate. In addition, any registered elector who cast a ballot in a question submitted election may request a recount in all or only specified voting areas to determine the result of the election.
Kentucky	✓	✓			As part of the official canvass, a manual recount of randomly selected precincts representing three to five percent of the total ballots cast in each election shall be completed. In addition, any candidate for election to any state, county, district or city office (with a few exceptions) who was voted for at a regular election may petition for a recount of the ballots.
Louisiana					None found.
Maine		✓		✓	If the margin between the number of votes cast for the leading candidate and the number of votes cast for the second place candidate is less than one percent of the total number of votes cast in that race, a recount is presumed necessary. In addition, a losing candidate may request a recount in any election by filing a written request with the Secretary of State within 5 business days after the election.
Maryland		✓			A candidate who has been defeated may petition for a recount of the votes cast for the office sought.
Massachusetts		✓	✓		A voter initiated petition for a recount may be filed on or before 5 pm on the tenth day following an election, provided that the written request for the recount is signed by the number of voters required by §135 and is signed by the candidate on whose behalf the recount is being conducted. State-wide recounts may only be authorized if the difference between the number of votes cast for the two leading candidates for the office is one half of one percent or less of the total votes cast for such office.

Michigan		✓	✓	✓	A candidate for any office (with a few exceptions) may petition for a recount of the votes cast for that office in any precinct, provided that the petition is filed not later than 48 hours after the completion of the canvass of votes cast at an election. A qualified registered elector who believes that there has been fraud or error committed by the inspectors of an election may also petition for a recount of the votes cast in any precinct, provided that the petition is filed not later than 2 days after the final certification of the canvass of votes. A recount of all precincts in the state shall be conducted any time a statewide election shall be certified by the board of state canvassers as having been determined by a vote differential of 2,000 votes or less.
Minnesota		✓		✓	In a state general election when the difference between the votes of a candidate who would otherwise be declared as elected and the votes of any other candidate for that office 1) is less than one-half of one percent of the total number of votes counted for that office or 2) is ten votes or less if the total number of votes cast for that office is 400 votes or less the canvassing board shall recount the votes. A losing candidate may request a recount at the candidate's own expense when the vote difference is greater than the difference stated above.
Mississippi					None found.
Missouri		✓			Any contestant in an election contest who was defeated by less than one percent of the votes cast for the office and any contestant who received the second highest number of votes cast for that office if two or more are to be elected and who was defeated by less than one percent of the votes cast shall have the right to request a recount of the votes cast for the office by filing the request with the secretary of state no later than seven days after the certification of the election.

Montana		✓			A recount must be conducted if a candidate for a congressional office, a state or district office voted on in more than one county, the legislature or judge of the district court is defeated by a margin not exceeding one-quarter of one percent of the total votes cast for all candidates for the same position and the defeated candidate, within 5 days after the official canvass, files a petition with the secretary of state. If a candidate for public office is defeated by a margin exceeding one-quarter of one percent but not exceeding one-half of one percent of the total votes cast for all candidates for the same position, he may, within 5 days after the official canvass, file a petition and post a bond to cover all the costs of the recount.
Nebraska		✓			If a candidate failed to be elected by a margin of 1) one percent or less of the votes received by the candidate who received the highest number of votes for the office at an election in which more than 500 total votes were cast or 2) two percent or less of the votes received by the candidate who received the highest number of votes for the office at an election in which 500 or less total votes were cast, then such candidate shall be entitled to a recount by filing a written request with the secretary of state. If a candidate fails to be elected by more than the margin stipulated above, the losing candidate may submit a certified written request for a recount at his or her expense.
Nevada		✓	✓		A candidate defeated at any election may demand a recount of the vote if within 3 working days after the certification of the vote the candidate files his demand in writing. Any voter may demand a recount of the vote for a ballot question if within 3 working days after the certification of the vote the candidate files his demand in writing.
New Hampshire		✓			Any person for whom a vote was cast and recorded for any office at a town election may, no later than the Friday following the election, apply in writing for a recount of the ballots cast for such office.

New Jersey		✓	✓		Any candidate at any election may, on or before the second Saturday following such election, apply for a recount of the votes cast. Any ten voters may, within a like time, apply for a recount of the votes cast at an election upon any public question.
New Mexico		✓			Any candidate for any office for which the state or county canvassing board issues a certificate of nomination or election may, within 6 days after the completion of the canvass, apply for a recount of paper ballots or a recheck of the votes shown on voting machines cast in the precinct.
New York	✓				Within 15 days after each general, specific or primary election and within 7 days after every village election conducted by the board of elections at which voting machines are used, the board of elections shall in each county using voting machines, shall recanvass the vote cast upon the voting machines according to the standards outlined in McKinney's Election Law § 9-208.
North Carolina		✓			In a ballot item within the jurisdiction of the State Board of elections, a candidate may submit a written demand for a recount if the difference between the votes for that candidate and the votes for a prevailing candidate are not more than 1) for a non-statewide ballot item, one percent of the total votes cast in the ballot item or in the case of a multi-seat ballot item, one percent of the votes cast for those two candidates. 2) for a statewide ballot item, one-half of one percent of the votes cast in the ballot item, or in the case of a multi-seat ballot item, one-half of one percent of the votes cast for those two candidates or 10,000 votes, whichever is less.
North Dakota		✓		✓	A recount must be conducted when a person failed to be elected in general or special election by one-half of one percent or less of the highest vote cast for a candidate for that office. A demand for a recount may be made by any person who failed to be elected in a general or special election by more than one-half of one percent and less than two percent of the highest vote cast for a candidate for that office, provided that the demand be made in writing within 3 days after the canvass of the votes and accompanied with a bond in an amount sufficient to pay for the cost of the recount.

Ohio		✓	✓	✓	If the number of votes cast for the declared winning candidate in a district election does not exceed the number of votes cast for the declared losing candidate by a margin of one-half of one percent or more of the total vote, a recount shall be conducted. If the number of votes cast for the declared winning candidate in a statewide election does not exceed the number of voted cast for the declared losing candidate by a margin of one-fourth of one percent or more of the total vote, a recount shall be conducted. Any candidate who was not declared elected may submit an application for a recount of the votes. Any group of 5 or more qualified electors may also file an application for a recount of the votes at an election upon any question or issue, provided that they either voted "Yes" or in favor of an issue that was defeated or they voted "No" or against an issue that was adopted.
Oklahoma		✓	✓		A losing candidate may request a recount of the ballots cast in an election. For elections on issues or questions when no candidate is involved, a recount may only be authorized after a registered voter and participant in the election files a petition with the election board signed by the number of voters required by 26 Okl.St. Ann. § 8-111(b)-(c).
Oregon		✓	✓	✓	A full recount of the votes cast shall be ordered if 1) two or more candidates have an equal and the highest number of votes or 2) the difference in the number of votes cast for a candidate apparently elected to the office and the closest defeated opponent is not more than one-fifth of one percent of the total votes for both candidates. A losing candidate may file a demand for a recount to be made in specified precincts. An elector may file a demand for a recount to be made in specified precincts in which votes were cast on any measure that appeared on the ballot.
Pennsylvania			✓		Three or more qualified electors in any general, municipal or primary election may file a petition for a recount by alleging fraud or error in the computation of votes cast for any office in an election district.

Rhode Island		✓			Any candidate may petition the state board of elections to conduct a recount by re-reading the programmed memory devices and comparing the results with the totals obtained on election night. If, after the recount, the candidate still trails the winning candidate by less than five percent and a discrepancy still exists, the candidate may request another recount to be performed by re-feeding the computer ballots into the voting equipment. If the candidate then trails the apparent winning candidate by less than three percent, the candidate may then request a manual recount of the votes cast.
South Carolina				✓	Whenever the difference between the number of votes received by a candidate who has been declared elected to an office in a general election and the number of votes received by any losing candidate is not more than one percent of the total votes which were cast, a recount shall be ordered unless such candidates waive a recount in writing.
South Dakota		✓	✓		If any candidate for an office, other than the Legislature, in a state or district election is defeated by a margin which does not exceed one-fourth of one percent of the total vote cast for all candidates for such office, the candidate may file a petition for a recount within 3 days after the completion of the official canvass. Any 3 registered voters of a precinct may also petition for the recount of votes as to the office or question specified, provided that the petition is filed within 10 days after the election.
Tennessee				✓	A recount may be ordered by any court or legislative body under any of the following circumstances: 1) a tie vote 2) an indication of fraud if the number of votes affected would be sufficient to change the result of an election 3) in any other instance the court finds that a recount is warranted.
Texas					None found.
Utah		✓	✓		When any candidate loses by not more than a total of one vote per voting precinct in a regular general election, the candidate may file a request for a recount within 7 days after the canvass. Any ten voters who voted in an election when any ballot proposition was on the ballot may file a request for a recount within 7 days of the canvass.

Vermont		✓	✓		A losing candidate may petition for a recount if the difference between the number of votes cast for a winning candidate and the number of votes cast for a losing candidate is less than five percent of the total votes cast for all the candidates for an office, divided by the number of persons to be elected. The result of an election for any office, other than for general assembly, or public question may be contested by any legal voter entitled to vote on the office or public question to be contested, provided that the complaint is filed within 15 days after the election in question, or if there is a recount, within 10 days after the court issues its judgment on the recount.
Virginia		✓	✓		A defeated candidate may request a recount of the votes if there is between any candidate apparently elected and any candidate apparently defeated a difference of not more than one percent of the total vote cast for the two such candidates. Fifty or more qualified voters may petition for a recount of the votes if the difference between the vote for a question and the vote against a question is not more than 50 votes or one percent of the total vote cast for and against the question, whichever is greater.
Washington		✓	✓	✓	If the official canvass of votes at any election reveals that the difference in the number of votes cast for a candidate apparently elected to any office and the number of votes cast for the closest apparently defeated opponent is less than 2,000 votes and also less than one-half of one percent of the total number of votes cast for both candidates, the canvassing board shall conduct a recount of all votes cast on that position. If the difference is less than 150 votes and also less than one-fourth of one percent of the total number of votes cast for both candidates, the votes shall be recounted manually. A losing candidate may also apply for a recount of the votes if the margin was greater than that specified above. A group of five or more registered voters may file a written application for a recount of the votes cast on any question or issue.
West Virginia	✓	✓			During the official canvass and any requested recount, at least five percent of the precincts are to be chosen at random and the ballot card cast therein counted manually. A losing candidate may also demand a recount within 48 hours after the certification of the election results.

Wisconsin		✓	✓		Any candidate voted for at an election or any elector who voted on a referendum question at any election may request a recount. The petition shall be filed no later than 5 pm on the third business day following the last meeting day of the last board of canvassers.
Wyoming		✓	✓	✓	There shall be a recount of the votes cast for any office in which the difference in number of votes cast for the winning candidate receiving the least number of votes and the losing candidate receiving the greatest number of votes is less than one percent of the number of votes cast for the winning candidate receiving the least number of votes cast for that office. A recount shall also be granted if a losing candidate files an affidavit alleging that fraud or error occurred in the canvassing of the votes. In addition, a recount of votes of a ballot proposition will be made if requested in an affidavit signed by 25 electors registered in a district voting on the question or if the proposition receives a number of votes, greater or lesser, within one percent of the number of votes required for passage.