



Jackson County Board of Election Commissioners, Independence, Mo.

Officials hope information technology will streamline the process of counting ballots and processing election records.

ences with voting systems. This suggests a need to focus efforts on building a foundation of applied research." Mark Frankel, author of an American Association for the Advancement of Science report on electronic voting, said recently that "it became quite clear to us how little knowledge we have of the interactions between voting technology and people. You hear a lot of anecdotes, but we don't have a systematic database about what's really happening."

Political scientists tend to study how people make decisions about voting, rather than how votes are cast and counted, Frankel said. Designing voting machines was left primarily to the companies that manufacture them, he added, while decisions about which machines to use were made largely by county officials with little or no technical expertise.

The 2000 problems could be seen as stemming from a failure to understand the vulnerabilities of punch-card technology. The 2004 voting machine controversy occurred because elections officials purchased electronic machines without taking into account computer scientists' warnings about potential vulnerabilities. Now, researchers are demonstrating that a wide range of subjects must be studied.

When MIT and Cal Tech researchers looked at the 2000 election, for instance, they estimated that between 4 and 6 million ballots were not counted nationwide. They concluded that between 1.5 and 2 million of the lost votes were caused by faulty equipment or confusing ballot design, aspects which received the most attention in the post-election uproar. But they also found that another 1.5 to 3 million losses stemmed from registration errors and that as many as 1 million came from problems at polling places, such as long lines, inconvenient voting hours and out-of-the-way locations.

"Hard" scientists play an important role in the research because optical scanners, computers and the Internet are at the heart of current or proposed voting systems. But the research teams tend to be interdisciplinary, with social and hard

Scientists Take Center Stage In U.S. Election Reform

Tom Price

Election reform legislation made an important stop in the House Science Committee as it wended its way through Congress after the 2000 presidential vote-counting debacle. There, Republican Vernon Ehlers and Democrat James Barcia—leaders of the technology and standards subcommittee—introduced a bill to put science at the center of the reform effort. When the broader Help America Vote Act finally passed Congress and was signed by President Bush in late 2002, most of the two Michigan lawmakers' proposals were included.

At the same time, scientific institutions were starting research projects of their own. A joint effort by the Massachusetts and California institutes of technology, for example, was launched two days after the Supreme Court settled the 2000 election. That group's early work helped shape the new voting law. Today, scientists across the country are probing various aspects of U.S. elections and making suggestions about how our voting system could be made more efficient, accurate and fair.

The best known aspect of the Help America Vote Act was funding to enable states to replace punch-card voting

systems, which were portrayed as the primary culprit in 2000. But the law also required the newly created Election Assistance Commission to establish voting technology standards and to accredit labs to test whether voting systems meet the standards or not. It charged the National Institute of Standards and Technology (NIST) with advising the commission. It also called for federal support of voting technology research.

"Most Americans pay no attention to this arcane field of technical specifications, tolerances and error rates," said House Science Committee Chairman Sherwood Boehlert, who called the process of setting standards "obscure and even boring." But, continued the New York Republican, "when it goes wrong—when the chads of punch-card ballots don't align correctly or when electronic voting machines automatically shut down before the polls are supposed to—the entire world quickly becomes all too familiar with (the) technical vocabulary."

The initial research has established the need for more research.

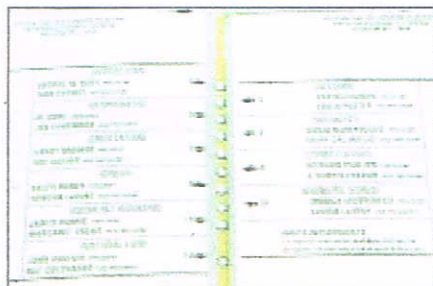
In a report to the Election Assistance Commission in April, NIST declared that "we know very little about users' experi-

scientists bringing their perspectives and expertise to bear. The Cal Tech-MIT Voting Technology Project is led by MIT computer scientist Ted Selker and Cal Tech political scientist Michael Alvarez.

"The interaction between the information technology group and the social scientists has been very productive because they think about problems differently than we do and vice versa," Alvarez said.

Selker said the collaboration "gives us a bigger bag of tricks. I have questions that the social scientists can answer, and I know things they don't."

Because some computer scientists warned about the difficulty of detecting fraud in electronic voting machines, Alvarez started working on what he calls "forensic election analysis." By applying computer data analysis to historical voting records at the precinct level, he said, it would be possible to detect anomalous voting patterns that would alert officials to investigate potential fraud.



Poorly designed ballots contributed to the 2000 election debacle. Better design and replacements of punch-card voting are among the topics on scientists' agendas.

Selker has been working to improve "audio ballots"—voting machines that speak the ballots through headphones, enabling the visually impaired to vote in privacy—and on new methods for testing the reliability of electronic voting technology.

Researchers also are investigating the potential for voting over the Internet; using information technology to improve

the accuracy of voter registration rolls; using IT to make county- or state-wide registration records available to precinct workers on election day so they can direct voters to the right polling place; ballot design; making voting machines easier for poll workers and voters to use; and providing poll workers with better training in using new election technology.

Researchers say they're heartened by the attention they're getting from officials, though they'd like (no surprise) more funding for their work. "Over the last four years, we've seen the development of a better working relationship between election officials and the research community," Alvarez said. Selker said he has been "surprised and honored by how much people have involved us, listened to us." "The rigor that scientists can bring to this issue has been recognized," Frankel said. "It just needs to be expanded."

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