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The Importance of Psychological Science in a Voter's Ability to Cast a Vote

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Abstract
Ensuring the integrity of elections is one of the most important elements in maintaining democracy. While it is commonly believed that threats to election integrity are primarily due to security issues, the reality is that voting systems that are not designed to support human perceptual and cognitive limitations also pose a serious and immediate threat. This mismatch between system design and human capabilities can cause tremendous difficulty for voters who are trying to cast a ballot, and has almost certainly altered the outcome of elections in the United States. This article describes the psychological issues that can impact the ability of a voter to cast a vote as intended.

Keywords
voting, human factors, usability, voting error

Voting is fundamental to democracy. Election integrity is one of the primary concerns of a democracy; elections must reflect the will of the voters. That is, every vote should be cast and counted as each individual voter intended. When thinking about election integrity, it is common to believe that the primary concern is the security of the voting process (Hall & Wang, 2008). Are ballot boxes safe from being stuffed with illegal ballots? Are computerized voting systems resistant to tampering? Will the vote-counting machines accurately count the ballots as they are marked? While these are all legitimate concerns, election integrity is broader than simple security.

In fact, some of the biggest threats to election integrity come not from unseen forces with nefarious intent but rather from voting-system designs that fail to account for the perceptual and cognitive limitations of the voters themselves, a task made more difficult because voters may be elderly or suffer from cognitive or physical disabilities. Technology that does not adequately support the human in the voting booth is a grossly underappreciated weak link in maintaining election integrity, and ensuring that voters can cast the ballot that they intend to cast is an enormous challenge (Byrne, Greene, & Everett, 2007; Herrnson et al., 2008). It is especially challenging in the United States because each state controls its own elections.

Voting Failures Due to Mismatches Between Human Capabilities and System Design

This failure of system design in the election process is aptly demonstrated by the infamous Florida butterfly ballot in the Bush-versus-Gore U.S. presidential election of 2000, shown in Figure 1. The arrangement of names on the ballot caused many voters to believe that they were voting for Al Gore, whose name was on the left side of the ballot, when in fact they were casting their ballots for a candidate listed on the right side of the ballot, Pat Buchanan (Sinclair, Mark, Moore, Lavis, & Soldat, 2000). Voters who did so were using a reasonable strategy: Holes and arrows do not always line up perfectly on butterfly ballots, so many voters simply count from the top. The strategy failed in this case, but would never have failed with any previous ballot in the jurisdiction in question. It is almost certainly the case that the number of votes that were miscast as a result of this voter confusion was greater than the margin of Bush's victory, and that they cost Al Gore the presidency (Wand et al., 2001).

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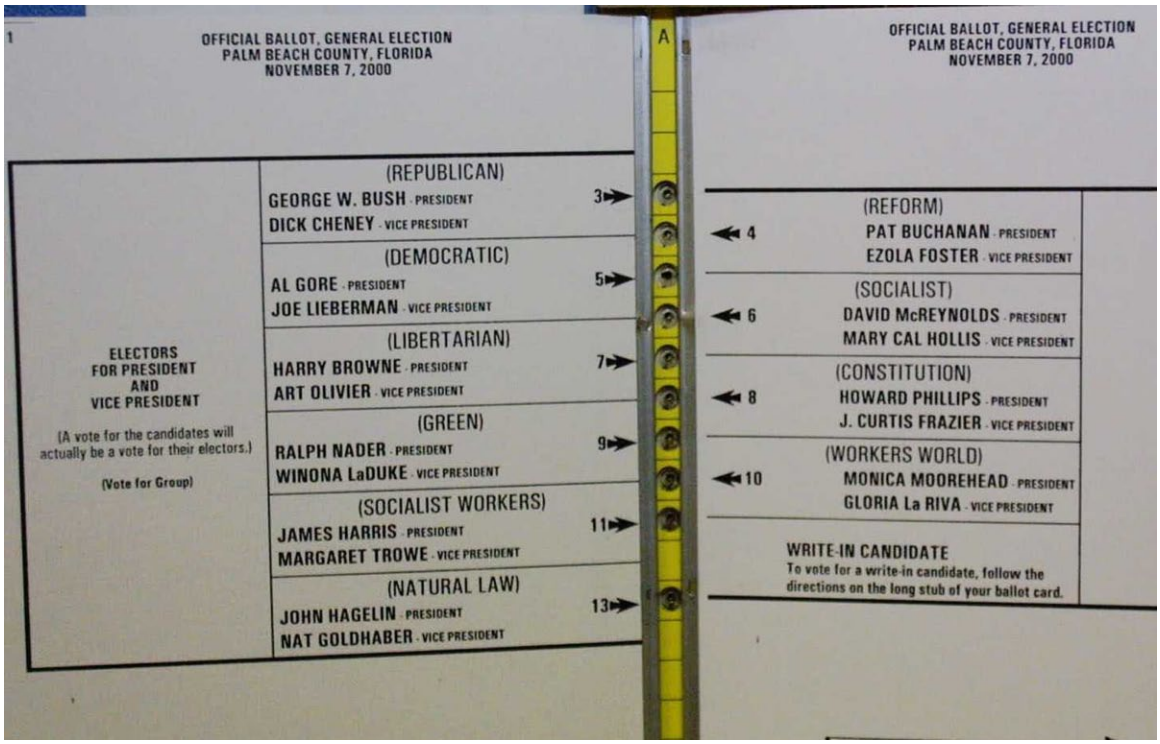


Fig. 1. The arrangement of names on this butterfly ballot used in Palm Beach County, Florida, for the 2000 U.S. presidential election made some voters believe that they were voting for Al Gore when in fact they were casting their ballots for Pat Buchanan. While the Democrats are listed as the second party on the left side of the ballot, a voter would need to mark the *third* hole (labeled 5) in order to cast such a vote. Marking the second hole (labeled 4) would cast a vote for the Reform Party.

It is not just unusual voting interfaces, like the butterfly ballot described above, that can cause voters to make systematic mistakes that impact the outcome of an election (Kimball & Kropf, 2005). This was clearly demonstrated by the 2008 Minnesota U.S. Senate election (Foley, 2011). With over 2.8 million votes cast, fewer than 300 votes separated candidates Al Franken and Norm Coleman, triggering an automatic recount. In this recount, Minnesota law required that officials try to determine the *intent* of the voter if the ballot was ambiguous (State of Minnesota, Office of the Revisor of Statutes, 2008). Even though marking paper ballots is generally considered routine, several thousand ballots were marked by voters in ways that made their intent difficult—if not impossible—to ascertain, as illustrated in Figure 2. The recount of such ambiguous ballots changed the initial Coleman win to a Franken win.

The difficulty that voters have in marking ballots can be especially troubling in computerized voting interfaces (Bederson, Lee, Sherman, Herrnson, & Niemi, 2003). For example, some states allow *straight-party voting*, in which a single button allows a voter to select all of the candidates who are affiliated with a certain party. However, voters often fail to understand how these global selection rules are applied when that party is not represented in a specific race or when a voter wishes to make an exception to the application of the rule in one or more races (Campbell & Byrne, 2009). These confusions can easily lead to selection errors.

Furthermore, something as simple as the layout of the ballot (Norden, Kimball, Quesenbery, & Chen, 2008) or the fonts and shading used (Kimball & Kropf, 2005) can adversely impact voters' ability to correctly mark their ballots. For example, consider the case of the 2006 Sarasota, Florida, ballot shown in Figure 3. Every other race on the ballot was presented on its own virtual page, but on this page, two races were presented. This design caused a large number of voters to fail to cast a vote (a phenomenon called *undervoting*) in the congressional race presented at the top of the page. In fact, the rate of undervoting for this race was six times as high in Sarasota relative to other jurisdictions that had different ballot designs (Frisina, Herron, Honaker, & Lewis, 2008). It is highly probable that the outcome of the race would have been reversed if the 18,000 voters who undervoted in this race had actually indicated their preference, as the margin of victory was smaller than 400 votes (Ash & Lamperti, 2008).

Sometimes the complexity of the ballot can make it difficult for voters to make a choice at all or to find the candidate for whom they intend to vote. An excellent example of this can be found in the 2003 California gubernatorial recall

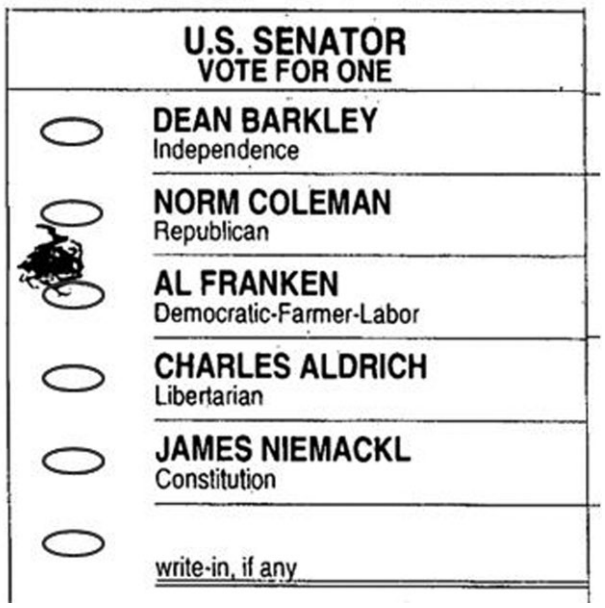


Fig. 2. Even seemingly simple ballots can lead to random errors that leave voter intent ambiguous, as this ballot from the 2008 Minnesota U.S. Senate race shows.

election. As can be seen in Figure 4, this race had 135 candidates, making it extremely difficult for voters to find a candidate. The long list of candidates also exacerbated a number of known selection biases, such as list order and name recognition, that could adversely impact election results (Miller & Krosnick, 1998).

It is tempting to discount these kinds of errors in selection by saying that the voter can always catch them through a final review of the ballot before it is cast. In reality, this is a classic signal-detection task (Green & Swets, 1966), and limitations associated with memory (voters may be unable to remember who they intended to vote for when they get to the review screen), attention (voters may feel fatigued or rushed by the voting process and therefore be less vigilant), and perception (missing or wrong votes may simply not be salient enough for voters to catch) all greatly interfere with voters' ability to validate their votes. Indeed, studies have shown that the majority of voters fail to detect deviations from their voting intent during their final review, even when up to a third of their votes have been intentionally altered (Everett, 2007).

Often the difficulty that voters have with casting a vote is not related to technology at all but has to do with the language that is used on the ballot. Reading and comprehension are complex cognitive activities, and almost a quarter of adults in the United States read below the fifth-grade level; 14% are functionally illiterate (Kutner, Greenburg, Jin, & Paulsen, 2006). Since the early 1970s, the use of literacy tests to exclude voters has been deemed unconstitutional (*Oregon v. Mitchell*, 1970), so clarity and ease of reading in ballot language is imperative. The construction of referendum questions on ballots is one area where complex language can lead voters to make mistakes because they cannot adequately understand the question being posed.

An excellent example can be found in a referendum question posed to Houston, Texas, voters in the fall of 2015. The city council had recently passed an equal-rights ordinance, and the voters were being asked whether they wanted this ordinance to stand. The mayor and the city council constructed the original language, shown in Figure 5. The language was ambiguous because it was unclear whether a "yes" vote meant the voter wished to repeal the amendment or vote in support of the equal-rights ordinance. Eventually, the Supreme Court of the State of Texas ruled that the original language was indeed unclear and demanded that the city rewrite the referendum question so that voters who were for the equal-rights amendment could vote "yes" and voters who were against the amendment could vote "no."

Ironically, sometimes the instructional language on the ballot that is supposed to clarify the actions a voter should take is actually the *cause* of the cognitive difficulties from which the voters suffer. An analysis of over 100 ballots from all 50 states showed that nearly all of them failed to conform to best practices for instruction writing (Laskowski & Redish, 2006). These deficiencies included the use of words that voters might not be familiar with, failures to consider the kinds of mistakes voters might make, inconsistent instructions (Howell & Kreidler, 1963), and instructions that did not cover important situations that voters would encounter when completing their ballot.

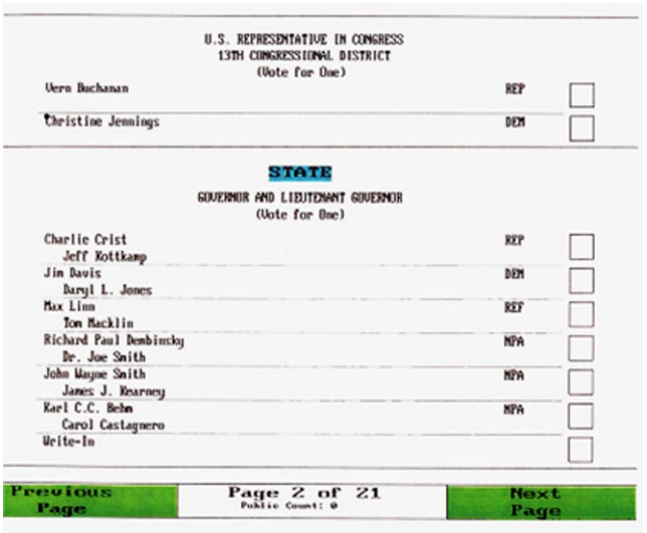
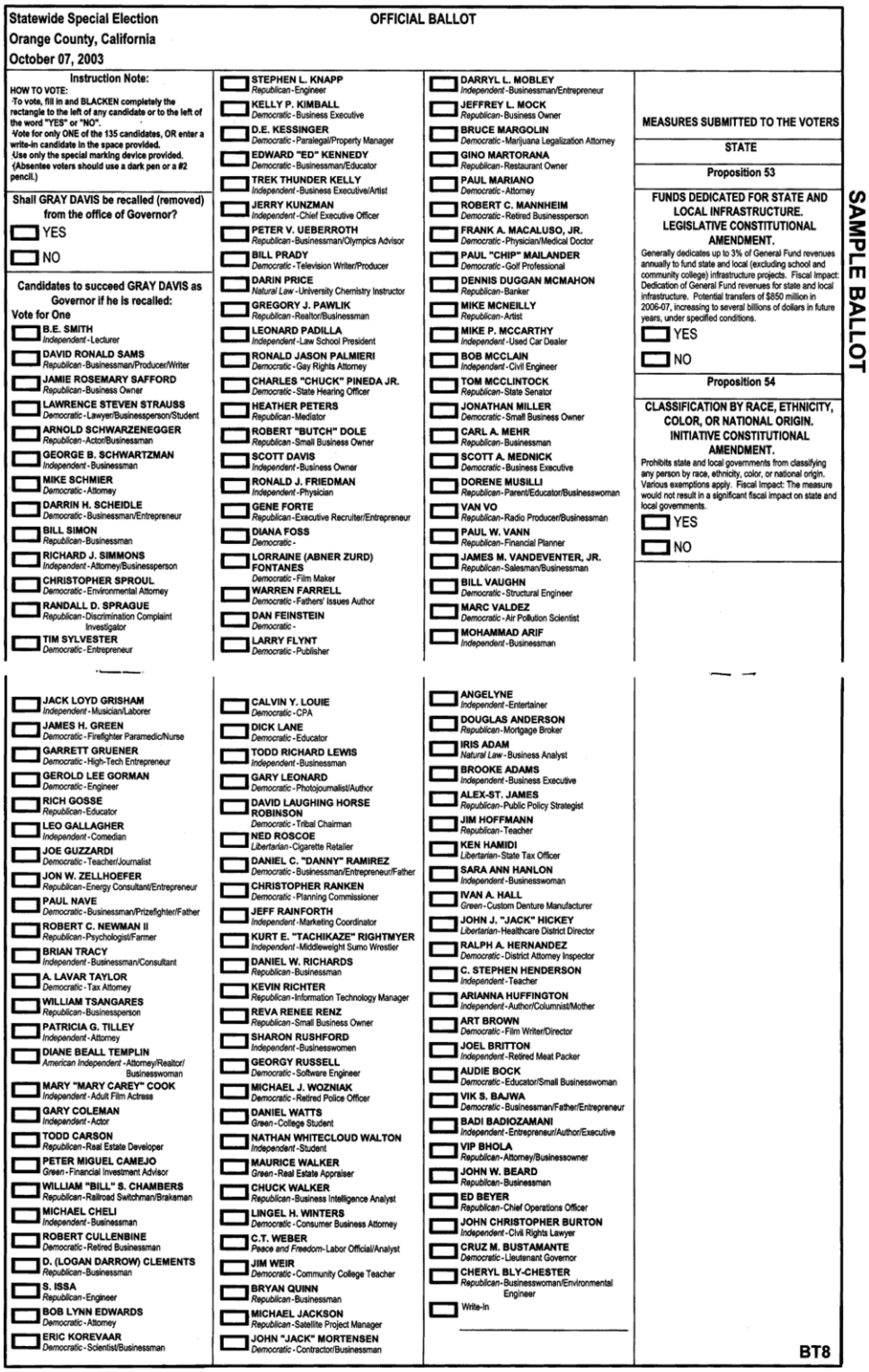


Fig. 3. Layout of the midterm election ballot used in Sarasota County, Florida, in 2006 that caused many voters to fail to vote in the congressional race at the top of the ballot.



Statewide Special Election
Orange County, California
October 07, 2003

OFFICIAL BALLOT

Instruction Note:
HOW TO VOTE:
·To vote, fill in and BLACKEN completely the rectangle to the left of any candidate or to the left of the word "YES" or "NO".
·Vote for only ONE of the 135 candidates, OR enter a write-in candidate in the space provided.
·Use only the special marking device provided.
·(Absentee voters should use a dark pen or a #2 pencil.)

Shall GRAY DAVIS be recalled (removed) from the office of Governor?
YES
NO

Candidates to succeed GRAY DAVIS as Governor if he is recalled:
Vote for One

B.E. SMITH — *Independent* - Lecturer
DAVID RONALD SAMS — *Republican* - Businessman/Producer/Writer
JAMIE ROSEMARY SAFFORD — *Republican* - Business Owner
LAWRENCE STEVEN STRAUSS — *Democratic* - Lawyer/Businessperson/Student
ARNOLD SCHWARZENEGGER — *Republican* - Actor/Businessman
GEORGE B. SCHWARTZMAN — *Independent* - Businessman
MIKE SCHMIER — *Democratic* - Attorney
DARRIN H. SCHEIDLE — *Democratic* - Businessman/Entrepreneur
BILL SIMON — *Republican* - Businessman
RICHARD J. SIMMONS — *Independent* - Attorney/Businessperson
CHRISTOPHER SPROUL — *Democratic* - Environmental Attorney
RANDALL D. SPRAGUE — *Republican* - Discrimination Complaint Investigator
TIM SYLVESTER — *Democratic* - Entrepreneur
STEPHEN L. KNAPP — *Republican* - Engineer
KELLY P. KIMBALL — *Democratic* - Business Executive
D.E. KESSINGER — *Democratic* - Paralegal/Property Manager
EDWARD "ED" KENNEDY — *Democratic* - Businessman/Educator
TREK THUNDER KELLY — *Independent* - Business Executive/Artist
JERRY KUNZMAN — *Independent* - Chief Executive Officer
PETER V. UEBERROTH — *Republican* - Businessman/Olympics Advisor
BILL PRADY — *Democratic* - Television Writer/Producer
DARIN PRICE — *Natural Law* - University Chemistry Instructor
GREGORY J. PAWLIK — *Republican* - Realtor/Businessman
LEONARD PADILLA — *Independent* - Law School President
RONALD JASON PALMIERI — *Democratic* - Gay Rights Attorney
CHARLES "CHUCK" PINEDA JR. — *Democratic* - State Hearing Officer
HEATHER PETERS — *Republican* - Mediator
ROBERT "BUTCH" DOLE — *Republican* - Small Business Owner
SCOTT DAVIS — *Independent* - Business Owner
RONALD J. FRIEDMAN — *Independent* - Physician
GENE FORTE — *Republican* - Executive Recruiter/Entrepreneur
DIANA FOSS — *Democratic* -
LORRAINE (ABNER ZURD) FONTANES — *Democratic* - Film Maker
WARREN FARRELL — *Democratic* - Fathers' Issues Author
DAN FEINSTEIN — *Democratic* -
LARRY FLYNT — *Democratic* - Publisher
DARRYL L. MOBLEY — *Independent* - Businessman/Entrepreneur
JEFFREY L. MOCK — *Republican* - Business Owner
BRUCE MARGOLIN — *Democratic* - Marijuana Legalization Attorney
GINO MARTORANA — *Republican* - Restaurant Owner
PAUL MARIANO — *Democratic* - Attorney
ROBERT C. MANNHEIM — *Democratic* - Retired Businessperson
FRANK A. MACALUSO, JR. — *Democratic* - Physician/Medical Doctor
PAUL "CHIP" MAILANDER — *Democratic* - Golf Professional
DENNIS DUGGAN MCMAHON — *Republican* - Banker
MIKE MCNEILLY — *Republican* - Artist
MIKE P. MCCARTHY — *Independent* - Used Car Dealer
BOB MCCLAIN — *Independent* - Civil Engineer
TOM MCCLINTOCK — *Republican* - State Senator
JONATHAN MILLER — *Democratic* - Small Business Owner
CARL A. MEHR — *Republican* - Businessman
SCOTT A. MEDNICK — *Democratic* - Business Executive
DORENE MUSILLI — *Republican* - Parent/Educator/Businesswoman
VAN VO — *Republican* - Radio Producer/Businessman
PAUL W. VANN — *Republican* - Financial Planner
JAMES M. VANDEVENTER, JR. — *Republican* - Salesman/Businessman
BILL VAUGHN — *Democratic* - Structural Engineer
MARC VALDEZ — *Democratic* - Air Pollution Scientist
MOHAMMAD ARIF — *Independent* - Businessman

MEASURES SUBMITTED TO THE VOTERS

STATE

Proposition 53

FUNDS DEDICATED FOR STATE AND LOCAL INFRASTRUCTURE. LEGISLATIVE CONSTITUTIONAL AMENDMENT.

Generally dedicates up to 3% of General Fund revenues annually to fund state and local (excluding school and community college) infrastructure projects. Fiscal Impact: Dedication of General Fund revenues for state and local infrastructure. Potential transfers of $850 million in 2006-07, increasing to several billions of dollars in future years, under specified conditions.

YES
NO

Proposition 54

CLASSIFICATION BY RACE, ETHNICITY, COLOR, OR NATIONAL ORIGIN. INITIATIVE CONSTITUTIONAL AMENDMENT.

Prohibits state and local governments from classifying any person by race, ethnicity, color, or national origin. Various exemptions apply. Fiscal Impact: The measure would not result in a significant fiscal impact on state and local governments.

YES
NO

SAMPLE BALLOT

JACK LOYD GRISHAM — *Independent* - Musician/Laborer
JAMES H. GREEN — *Democratic* - Firefighter Paramedic/Nurse
GARRETT GRUENER — *Democratic* - High-Tech Entrepreneur
GEROLD LEE GORMAN — *Democratic* - Engineer
RICH GOSSE — *Republican* - Educator
LEO GALLAGHER — *Independent* - Comedian
JOE GUZZARDI — *Democratic* - Teacher/Journalist
JON W. ZELLHOEFER — *Republican* - Energy Consultant/Entrepreneur
PAUL NAVE — *Democratic* - Businessman/Prizefighter/Father
ROBERT C. NEWMAN II — *Republican* - Psychologist/Farmer
BRIAN TRACY — *Independent* - Businessman/Consultant
A. LAVAR TAYLOR — *Democratic* - Tax Attorney
WILLIAM TSANGARES — *Republican* - Businessperson
PATRICIA G. TILLEY — *Independent* - Attorney
DIANE BEALL TEMPLIN — *American Independent* - Attorney/Realtor/Businesswoman
MARY "MARY CAREY" COOK — *Independent* - Adult Film Actress
GARY COLEMAN — *Independent* - Actor
TODD CARSON — *Republican* - Real Estate Developer
PETER MIGUEL CAMEJO — *Green* - Financial Investment Advisor
WILLIAM "BILL" S. CHAMBERS — *Republican* - Railroad Switchman/Brakeman
MICHAEL CHELI — *Independent* - Businessman
ROBERT CULLENBINE — *Democratic* - Retired Businessman
D. (LOGAN DARROW) CLEMENTS — *Republican* - Businessman
S. ISSA — *Republican* - Engineer
BOB LYNN EDWARDS — *Democratic* - Attorney
ERIC KOREVAAR — *Democratic* - Scientist/Businessman
CALVIN Y. LOUIE — *Democratic* - CPA
DICK LANE — *Democratic* - Educator
TODD RICHARD LEWIS — *Independent* - Businessman
GARY LEONARD — *Democratic* - Photojournalist/Author
DAVID LAUGHING HORSE ROBINSON — *Democratic* - Tribal Chairman
NED ROSCOE — *Libertarian* - Cigarette Retailer
DANIEL C. "DANNY" RAMIREZ — *Democratic* - Businessman/Entrepreneur/Father
CHRISTOPHER RANKEN — *Democratic* - Planning Commissioner
JEFF RAINFORTH — *Independent* - Marketing Coordinator
KURT E. "TACHIKAZE" RIGHTMYER — *Independent* - Middleweight Sumo Wrestler
DANIEL W. RICHARDS — *Republican* - Businessman
KEVIN RICHTER — *Republican* - Information Technology Manager
REVA RENEE RENZ — *Republican* - Small Business Owner
SHARON RUSHFORD — *Independent* - Businesswomen
GEORGY RUSSELL — *Democratic* - Software Engineer
MICHAEL J. WOZNIAK — *Democratic* - Retired Police Officer
DANIEL WATTS — *Green* - College Student
NATHAN WHITECLOUD WALTON — *Independent* - Student
MAURICE WALKER — *Green* - Real Estate Appraiser
CHUCK WALKER — *Republican* - Business Intelligence Analyst
LINGEL H. WINTERS — *Democratic* - Consumer Business Attorney
C.T. WEBER — *Peace and Freedom* - Labor Official/Analyst
JIM WEIR — *Democratic* - Community College Teacher
BRYAN QUINN — *Republican* - Businessman
MICHAEL JACKSON — *Republican* - Satellite Project Manager
JOHN "JACK" MORTENSEN — *Democratic* - Contractor/Businessman
ANGELYNE — *Independent* - Entertainer
DOUGLAS ANDERSON — *Republican* - Mortgage Broker
IRIS ADAM — *Natural Law* - Business Analyst
BROOKE ADAMS — *Independent* - Business Executive
ALEX-ST. JAMES — *Republican* - Public Policy Strategist
JIM HOFFMANN — *Republican* - Teacher
KEN HAMIDI — *Libertarian* - State Tax Officer
SARA ANN HANLON — *Independent* - Businesswoman
IVAN A. HALL — *Green* - Custom Denture Manufacturer
JOHN J. "JACK" HICKEY — *Libertarian* - Healthcare District Director
RALPH A. HERNANDEZ — *Democratic* - District Attorney Inspector
C. STEPHEN HENDERSON — *Independent* - Teacher
ARIANNA HUFFINGTON — *Independent* - Author/Columnist/Mother
ART BROWN — *Democratic* - Film Writer/Director
JOEL BRITTON — *Independent* - Retired Meat Packer
AUDIE BOCK — *Democratic* - Educator/Small Businesswoman
VIK S. BAJWA — *Democratic* - Businessman/Father/Entrepreneur
BADI BADIOZAMANI — *Independent* - Entrepreneur/Author/Executive
VIP BHOLA — *Republican* - Attorney/Businessowner
JOHN W. BEARD — *Republican* - Businessman
ED BEYER — *Republican* - Chief Operations Officer
JOHN CHRISTOPHER BURTON — *Independent* - Civil Rights Lawyer
CRUZ M. BUSTAMANTE — *Democratic* - Lieutenant Governor
CHERYL BLY-CHESTER — *Republican* - Businesswoman/Environmental Engineer
Write-In

BT8

Fig. 4. Sometimes the sheer number of candidates whose names must be presented in a race can make it difficult to vote, as shown here from the 2003 California gubernatorial race.

A case in point is the paper ballot used in Florida in the 2000 U.S. presidential election. As can be seen in Figure 6, the instructions for the presidential race noted that voters should "Vote for Group," whereas the instructions for the other races on the ballot noted that voters should "Vote for One." These conflicting instructions

The referendum language as originally proposed by the City of Houston

Shall the City of Houston repeal the Houston Equal Rights Ordinance, Ord. No. 2014-530, which prohibits discrimination in city employment and city services, city contracts, public accommodations, private employment, and housing based on an individual's sex, race, color, ethnicity, national origin, age, familial status, marital status, military status, religion, disability, sexual orientation, genetic information, gender identity, or pregnancy?

The referendum language that was actually on the ballot after intervention by the Supreme Court of Texas

Are you in favor of the Houston Equal Rights Ordinance, Ord. No. 2014-530, which prohibits discrimination in city employment and city services, city contracts, public accommodations, private employment, and housing based on an individual's sex, race, color, ethnicity, national origin, age, familial status, marital status, military status, religion, disability, sexual orientation, genetic information, gender identity, or pregnancy?

Fig. 5. Confusing ballot language used for a vote on a referendum question in Houston, Texas, that was ordered changed by the Texas Supreme Court to add clarity for voters, and the amended version after the ruling.

caused significant confusion, and over 100,000 voters cast votes for more than one presidential candidate (a phenomenon called *overvoting*), which invalidated the voters' selection on that race. Following these difficulties, the ballot language was initially changed to say "Vote for One Pair." This language was never used, however, as lawsuits forced election administrators to change all of the ballot language to say "Vote for One."

Even if voters have successfully and correctly marked their ballots, they can still fail to cast their vote correctly. In this scenario, voters mark their ballots, carefully review their choices, and then fail to press the "Cast" button before walking away from the voting booth, or walk away with their completed ballot. This *postcompletion error* occurs because voters believe they have completed their task when in fact they have completed only a portion of it (Byrne & Bovair, 1997).

Possible Reasons for These Voting Difficulties

Voting is not a new activity. How could deficits of this magnitude exist, given the thousands of elections that have occurred in the United States since the founding of the country? Unfortunately, there is no single cause. One partial explanation is that people simply do not vote very often. In the consumer marketplace, technologies have the advantage of repeated use, and learnability and memorability are two characteristics of consumer systems that are highly valued. One might not understand how to use a new smartphone at first, but after repeated exposure to the device and its procedures, its operation can become almost second nature. Unfortunately, this is not the case with voting systems. Voting systems suffer from the fact that voters interact with systems infrequently (perhaps once every 2 or 4 years), and the systems often change over time (Jones, 2003) and from polling location to polling location, making it difficult for any of the benefits of learning or training to accrue (Traugott et al., 2005).

Another key factor in the pervasiveness of this problem is that there is not one person or agency in charge of all elections in the United States. The U.S. Constitution grants the power to administer elections to the states rather than the federal government, and most states effectively delegate that authority to the individual counties within the state. This means that thousands of county clerks across the nation are making independent decisions about how to best construct ballot systems and ballot language (Niemi & Herrnson, 2003). Although the federal government has taken steps to provide guidance through the Election Assistance Commission and the issuance of the Voluntary Voting System Guidelines (U.S. Election Assistance Commission, 2015), the information

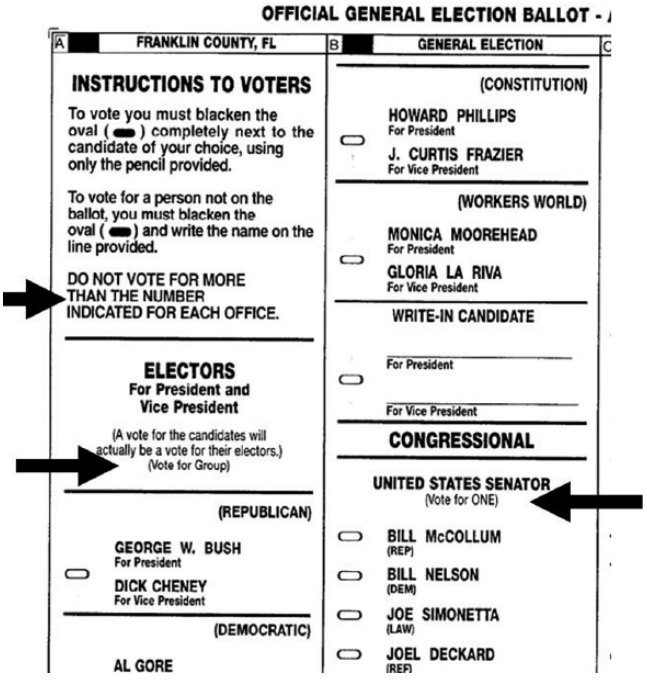


Fig. 6. Confusing instructions on the Florida ballot that caused over 100,000 voters to vote for more than one candidate in the 2000 U.S. presidential race, thus invalidating their vote.

provided is advisory only, and the states are free to conduct their elections as they see fit. The result is a patchwork of different laws that regulate elections and different voting systems, each of which has its own psychological characteristics and potential design weaknesses.

What Can Be Done?

Given what is known about the threat that these psychological issues pose to our elections, what can be done?

1. Work to design usable systems

Psychologists need to continue to do applied research on designing voting interfaces and systems that will allow voters to use them easily in a walk-up-and-use fashion. Since systems purchased in the wake of the issues surrounding the 2000 election in Florida are now coming to the end of their service life, now is an opportune time for researchers to apply their knowledge of cognitive science in the design of new, usable voting systems. This has already started in California (County of Los Angles, n.d.) and Texas (Bell et al., 2013), where election officials are collaborating with human-factors experts on the design of new systems.

2. Expand support to local election officials

Researchers studying how to create better election systems have created training materials and guides that can be exceptionally helpful to election officials (e.g. Chisnell, 2015). Unfortunately, this research often does not find its way into the hands of the practitioners who need it the most. Researchers and voting-rights groups should work to disseminate this kind of information to those officials on the front lines of voting and stand ready to assist through consultation and training or in more concrete ways, such as by becoming poll workers or election judges.

3. Create automated tools to help identify ballot problems

In the longer term, additional research needs to be conducted to develop robust methods of system and ballot checking (Laskowski, Autry, Cugini, Killam, & Yen, 2004). Because tens of thousands of different ballots are deployed in each election cycle and most election officials lack the requisite background in psychology to verify the usability and psychological soundness of those ballots, research needs to be conducted on developing and fielding automated ballot-checking systems that use cognitive models to identify potential problems (e.g., Greene, 2011). If these systems were Web-based, so that an election official would only need to upload a ballot image, individual election officials could check the goodness of their election materials *before* an election.

Conclusions

In summary, it is clear that psychological science plays an important, and often underappreciated, role in our elections. As politicians are wont to say, elections have consequences. The inability of voters to cast their votes as intended because voting systems have not been designed to account for the ways in which human cognitive and perceptual systems work suggests that those consequences are a real threat to election integrity.

Recommended Reading

Herrnson, P. S., Niemi, R. G., Hanmer, M. J., Bederson, B. B., Conrad, F. G., & Traugott, M. W. (2008). (See References). A book describing the difficulties associated with a number of different electronic voting technologies.

Jones, D. W. (2003). (See References). A short review of the wide variety of voting technologies that have been employed in elections.

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