

# The Paper Ballot is Not Enough.

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**Ben Adida**



January 31st, 2017



ENIGMA.

A USENIX CONFERENCE



- **“It’s close, let’s recount.”**  
- **e2e verifiable voting can provide evidence.**
- **ignored for too long in favor of paper alone.**
- **Paper + e2e audit trails → Evidence-based recounts!**

DISTRICT OF COLUMBIA

# OFFICIAL BALLOT

PRESIDENTIAL ELECTION—NOVEMBER 3, 1964

Place a mark in the box beside the names of the candidates for whom you wish to vote.



Republican

BARRY GOLDWATER, President, and  
WILLIAM E. MILLER, Vice-President



Democratic

LYNDON B. JOHNSON, President, and  
HUBERT H. HUMPHREY, Vice-President

Fold Here  
before leaving voting booth.

OFFICIAL BALLOT - CONTINUACION  
BOTA OFICIAL - CONTINUACION

MEASURES SUBMITTED TO THE VOTERS  
MEDIDAS SOMETIDAS A LOS VOTANTES

STATE  
ESTATAL

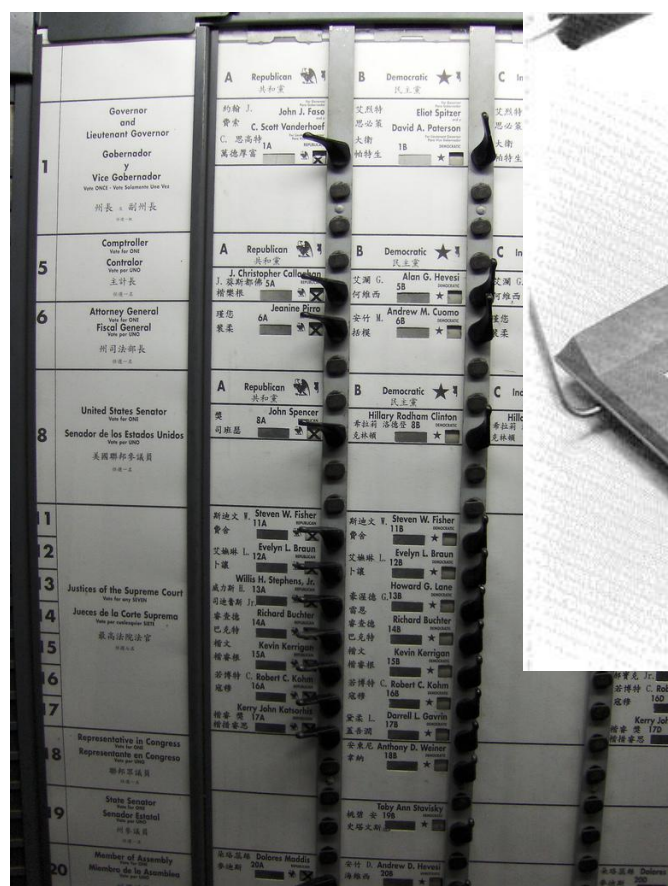
19

LEGALIZES MARIJUANA UNDER CALIFORNIA BUT NOT FEDERAL LAW. LOCAL GOVERNMENTS TO REGULATE AND TAX COMMERCIAL DISTRIBUTION, AND SALE OF MARIJUANA. INITIATIVE STATUTE. All persons 21 years old or older to possess, cultivate, or transport marijuana for personal use. Depending on federal, state, and local government actions, potential increased tax and the hundreds of millions of dollars annually and potential correctional savings of several dollars annually.

LEGALIZA LA MARIHUANA SEGUN LA LEY DE CALIFORNIA, PERO NO LA LEY FEDERAL. PERMITE QUE LOS GOBIERNOS LOCALES REGULEN Y GRAVEN LA PRODUCCION, DISTRIBUCION Y VENTA DE MARIHUANA. LEY POR INICIATIVA. Permite que todas las personas de 21 años de edad o mayores posean, cultiven o transporten marihuana para uso personal. Dependiendo de los actos gubernamentales federales, estatales y locales, potenciales recaudaciones impositivas y de cargos de cientos de millones de dólares anuales y de ahorros de varias decenas de millones de dólares anuales.

20

REDISTRICTING OF CONGRESSIONAL DISTRICTS. INITIATIVE AMENDMENT. Removes elected representatives from process of redistricting and transfers that authority to recently-authorized 14-member committee of representatives of neither party. F



<https://www.flickr.com/photos/joeshlabotnik/1856970162>  
<https://www.flickr.com/photos/michigancommunities/7164750360>  
<https://www.flickr.com/photos/mzn37/291643230>



1	-	39	-	-	115	136	-	191	210
-	20	40	59	77	96	116	133	172	200
2	21	41	60	78	97	117	135	184	211
-	3	22	42	61	80	118	137	174	212
4	-	23	43	62	81	119	138	176	213
5	-	24	44	63	82	120	139	178	214
6	-	25	45	64	83	121	140	180	215
7	-	26	46	65	84	122	141	182	216
8	-	27	47	66	85	123	142	184	217
9	-	28	48	67	86	124	143	186	218
10	-	29	49	68	87	125	144	188	219
11	-	30	50	69	88	126	145	190	220
12	-	31	51	70	89	127	146	192	221
13	-	32	52	71	90	128	147	194	222
14	-	33	53	72	91	129	148	196	223
15	-	34	54	73	92	130	149	198	224
16	-	35	55	74	93	131	150	200	225
17	-	36	56	75	94	132	151	202	226
18	-	37	57	76	95	133	152	204	227
19	-	38	58	77	96	134	153	206	228

TO BE FOLDED BY ELECTION BOARD ONLY  
PRECINCT NO. 1961 WRITE IN NO.

# Help America Vote Act

From Wikipedia, the free encyclopedia

The **Help America Vote Act of 2002** ([Pub.L. 107–252](#)), or **HAVA**, is a [United States federal law](#) which passed in the [House](#) 357-48 and 92-2 in the [Senate](#)<sup>[1]</sup> and was signed into law by [President Bush](#) on October 29, 2002.<sup>[2]</sup> Drafted (at least in part) in reaction to the controversy surrounding the [2000 U.S. presidential election](#), when almost two million ballots were disqualified because they registered multiple votes or none when run through vote-counting machines.<sup>[3]</sup>

The goals of HAVA are:<sup>[4]</sup>

- replace punchcard and lever-based [voting systems](#);
- create the [Election Assistance Commission](#) to assist in the administration of federal elections; and
- establish minimum [election administration](#) standards.

HAVA mandates that all states and localities upgrade many aspects of their election procedures, including their voting machines, registration processes and poll worker training. The specifics of implementation have been left up to each state, which allows for varying interpretations of the federal law.



NOVEMBER 3, 2008

**Exclusive:** Joe Klein Grills Obama  
On Petraeus, the end of easy money and his No. 1 priority



# TIME

## 7 Things That Could Go Wrong on Election Day

Breaking machines, crashing computers, vanishing votes—are we ready for 130 million voters? If you're worried about your vote not counting, here's what you can do about it

BY MICHAEL SCHERER



The Diebold AccuVote-TS electronic voting machine. (Let's hope it works)

**It's okay,  
let's have paper  
we can recount**



**How did the  
paper recount go  
in Michigan?**

- **Rumors of Russian interference (CIA)**
- **The margin was tight (0.25%)**
- **Candidate asked for recount (Stein)**
- **The money was there (\$6MM)**
- **The deadline was met**
- **Experts available to help (Halderman)**
- **And yet....**

## Half of Detroit votes may be ineligible for recount

[Chad Livengood and Joel Kurth](#), The Detroit News 2:54 p.m. EST December 6, 2016



Ingham County Clerk Barb Byrum explains how entire voting precincts may be non-recountable in the presidential election recount that began Monday in Ingham and Oakland counties. Chad Livengood, The Detroit News



61687



237



745

### TOP VIDEOS



Delphi V2X technology

0:44



Did this parrot witness suicide?

2:09

**MICHIGAN ELECTION LAW (EXCERPT)**  
**Act 116 of 1954**

**168.871 Recount; use of electronic voting system; use of voting machines; recount of absent voter ballots; procedures for conduct of recount; use of computer; testing software application.**

Sec. 871.

(1) The board of canvassers conducting a recount pursuant to this chapter shall recount all ballots of a precinct using an electronic voting system unless 1 or more of the following circumstances exist:

(a) The seal on the transfer case or other ballot container is broken or bears a different number than that recorded on the poll book, the breaking or discrepancy is not explained to the satisfaction of the board of canvassers, and security of the ballots has not been otherwise preserved.

(b) The number of ballots to be recounted and the number of ballots issued on election day as shown on the poll list or the computer printout do not match and the difference is not explained to the satisfaction of the board of canvassers.

(c) The seal used to seal the ballot label assembly to a voting device in the precinct is broken or bears a different number than that recorded in poll records and the ballot labels or rotation of candidates' names is different than that shown by other voting devices in the precinct and records of the board of election commissioners.

(2) This section does not prohibit the recounting of absent voter ballots tallied in a precinct using an absent voter counting board or

I guess my  
vote's in there  
somewhere.



Carmen

### Michigan Election Record

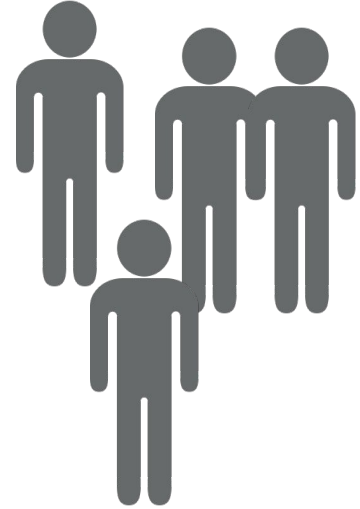
## Tally

Hillary: 2,268,839

Donald: 2,279,543

Donald wins.

It's close! 0.25%.  
Let's recount.



**Classic election integrity checks  
are very, very weak.**



## Michigan election director: **No election hack evidence**

[Michael Gerstein](#), The Detroit News

Published 2:45 p.m. ET Nov. 23, 2016 | Updated 4:57 p.m. ET Nov. 24, 2016



(Photo: Detroit News file photo)

*Lansing* — The state's election director said there is no evidence that Michigan's presidential election results were manipulated or hacked amid concern from a group of computer scientists and election lawyers about that potential.

The group is urging former Democratic presidential candidate Hillary Clinton to request a recount of the election results in Michigan, Wisconsin and Pennsylvania, [according to a report originally from New York magazine](#). They're concerned the election results may have been manipulated, according to the report.

### TOP VIDEOS



493



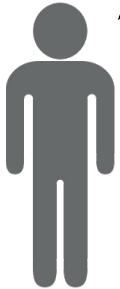
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**We can do better!**

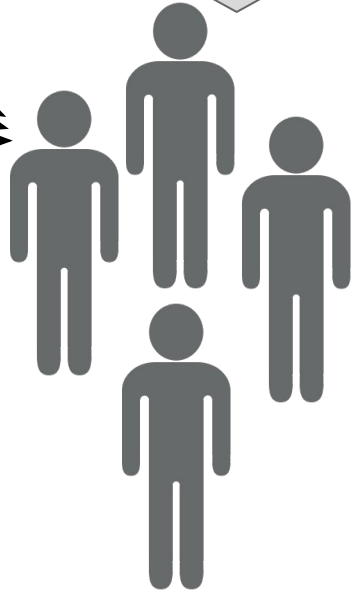
**We can have evidence  
baked into voting process.**

There's my vote!



Carmen

<u>Election Record</u>		
Alice	-	Hillary
Bob	-	Donald
<b>Carmen</b>	-	<b>Donald</b>
David	-	Hillary
Erica	-	Hillary
.....		
<u>Tally</u>		
Hillary:	2,268,839	
Donald:	2,279,543	



All the votes add up to declared tally!



# **Insights from Helios**



<https://heliosvoting.org>

- Web-based, end-to-end verifiable
- 1M votes cast in 10y.
- IACR, ACM, Greenpeace, Universities,...
- USENIX Security 2008, 2009
- First of many similar systems  
Wombat (Israel), Agora (Spain), Coasca (Australia), DEMOS (Greece), ...

Michigan Election Record

**Alice** – Hillary  
**Bob** – Donald  
**Carmen** – Donald  
**David** – Hillary  
**Erica** – Hillary

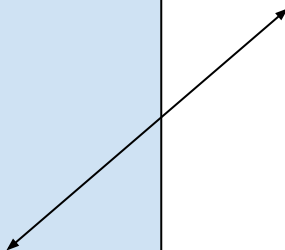
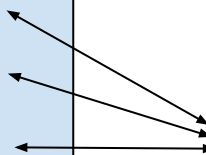
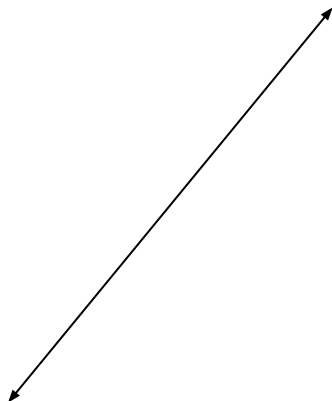
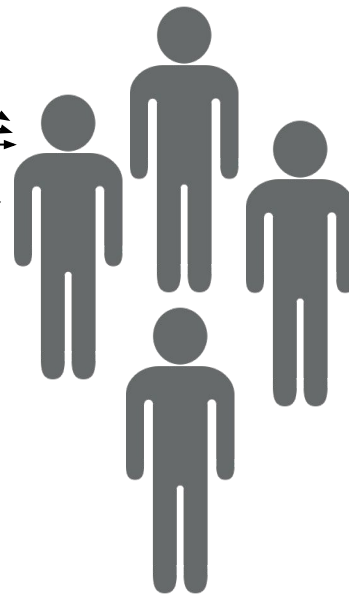
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**Tally**

Hillary: 2,268,839  
Donald: 2,279,543



Carmen



### Michigan Election Record

**Alice** — b459e2a096  
**Bob** — 81a40a3873  
**Carmen** — 37f772241c  
**David** — 658158292d  
**Erica** — de44130da1

.....

### Tally

Hillary: 2,268,839  
Donald: 2,279,543  
Tally Proof: b861c156c95,  
c8faf2c7fe9, 4baac05668,  
e4212fddb5, ...

There's my tracking number!

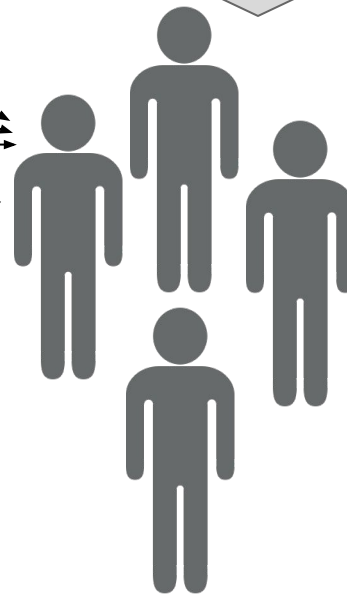


Carmen

Vote Tracker

37f772241c

The vote trackers match the declared tally!

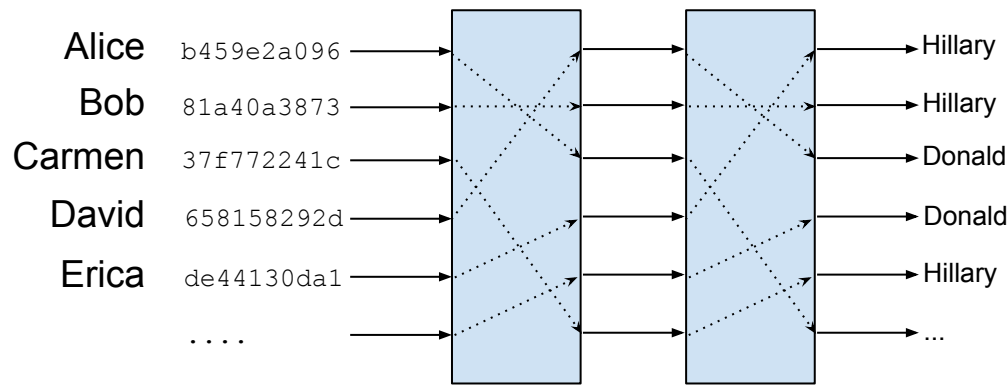


# Two techniques for private vote tallying.

	Hillary	Donald
Alice	b459e2a096	
Bob	81a40a3873	
Carmen	37f772241c	
David	658158292d	
Erica	de44130da1	
....		
	2,268,839	2,279,543

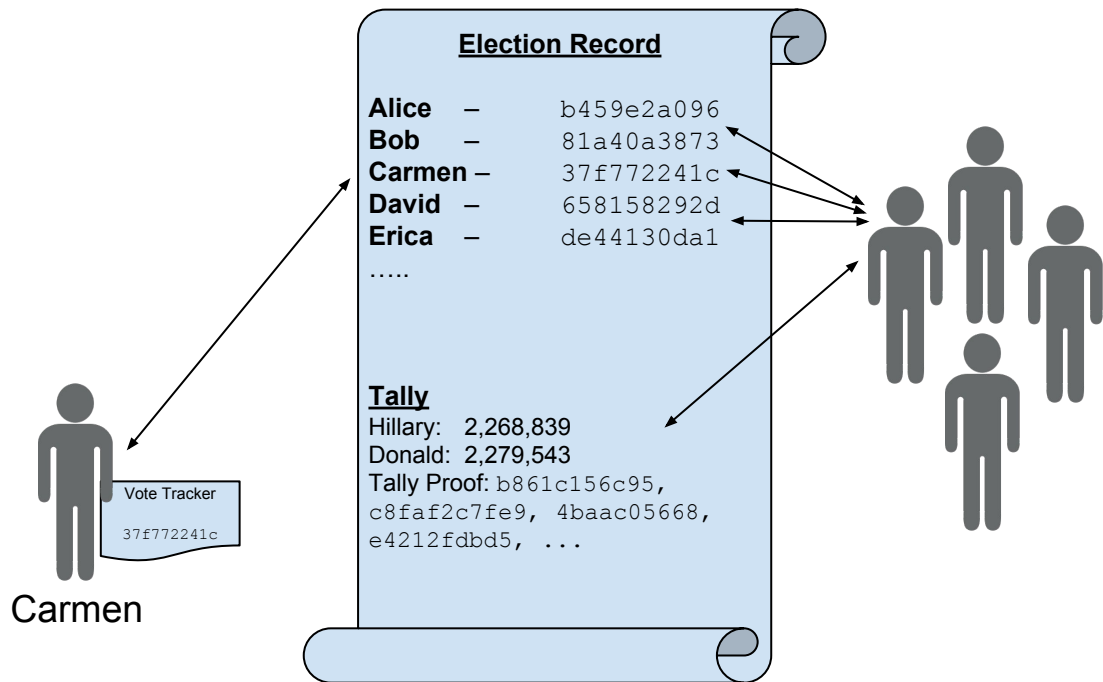
## Homomorphic encryption:

Add votes under cover of encryption.



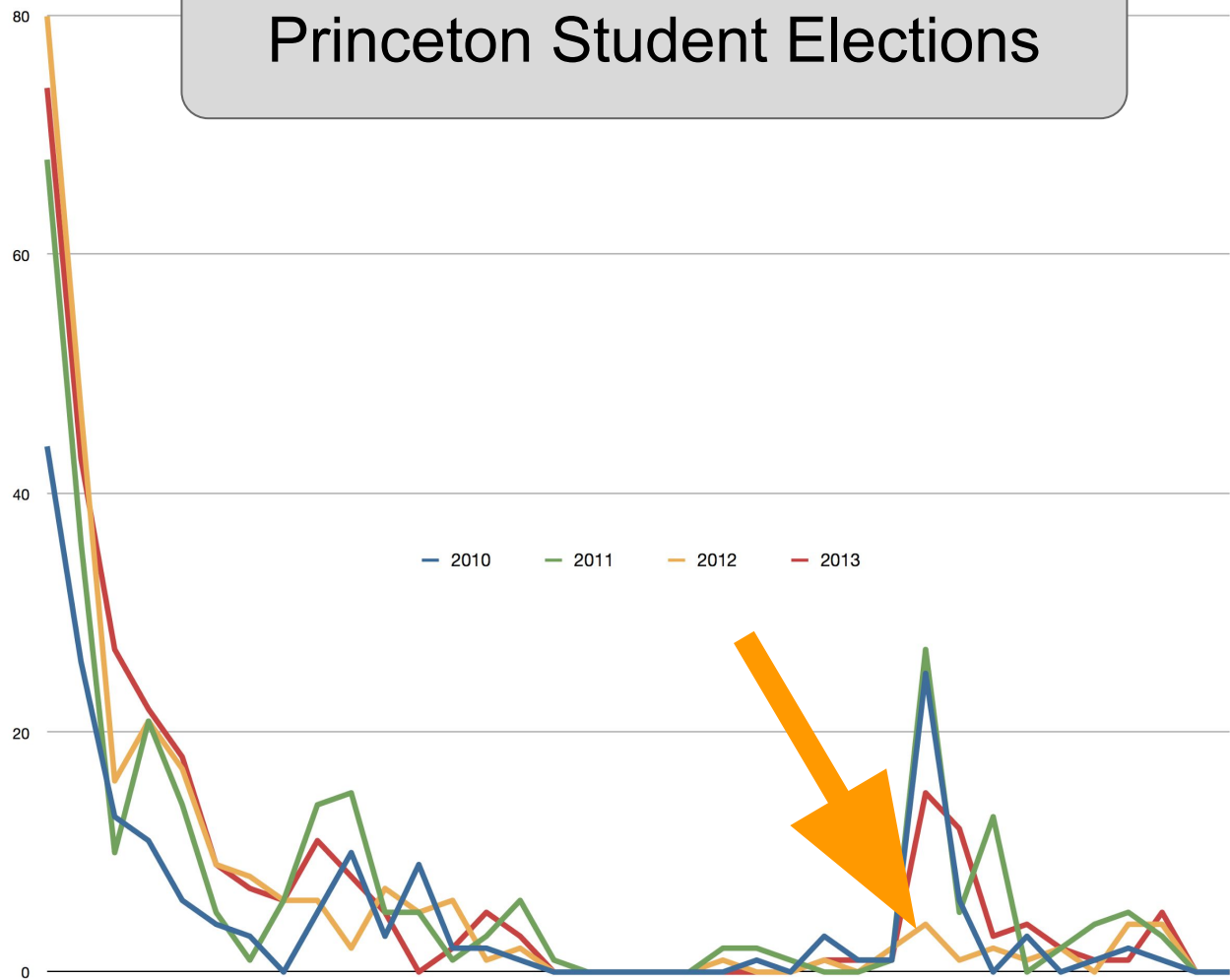
## Mixnets:

Shuffle & reencrypt votes, decrypt individual outputs.



**Act of voting creates an audit trail that anyone can verify. Evidence for a more thorough investigation.**

# Princeton Student Elections





# Travis County now taking bids for new voting system

By [Calily Bien](#)

Published: October 10, 2016, 1:17 pm | Updated: October 10, 2016, 1:17 pm





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- **e2e verifiable voting can provide evidence.**
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- **Paper + e2e audit trails → Evidence-based recounts!**

**Evidence in  
other parts of the  
voting process?**

**Voter registration lists  
are public information.**

CBS NEWS / *January 23, 2017, 10:57 PM*

# **Trump claims 3-5M illegal ballots cost him popular vote, cites no evidence**

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*Last Updated Jan 24, 2017 2:04 PM EST*

# Let's do some math

- 3M fraudulent / 130M cast → 2%
- Pick 1,000 voters. Check eligibility.
- $1 - (0.98^{1000}) \rightarrow 1 - 5 \times 10^{-8}$   
chance of detecting that kind fraud
- Don't think it's evenly distributed?
- Pick your favorite evil state, say California.
- 1M fraudulent / 18M cast → 5%
- $1 - (0.95^{1000}) \rightarrow 1 - 10^{-22}$
- Anyone can check. The DOJ. The Press. A high-schooler.
- 4 fraudulent votes in 2016.

THE TIMES OF INDIA

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# India's democracy reaches out to lone voter in Gujarat's Gir forest

IANNS | Apr 20, 2014, 06.17 PM IST



A-

A+

**Democracy works only if  
we agree to play  
by some basic rules.**

**One of those rules is  
everyone gets a vote.**

# Q&A



@benadida

@heliosvoting

<https://heliosvoting.org>

# #Resist