

Presentation Timeline

12:35- 12:55 (Paper 1)

12:56- 1:16 (paper 2)

1:17-1:37 (paper 3)

Try to end by 1:45

H20	H19	H18	H17	H16	H15	H14	H13	H12	H11	H10	H9	H8	H7
G20	G19	G18	G17	G16	G15	G14	G13	G12	G11	G10	G9	G8	G7
Nishanth	Abeer				Ross	Cheng					Harrison	Kayla	
F20	F19	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7
Jason	Anirudh				Mokshita	Aniaz					Shreyas	Joshua	
E20	E19	E18	E17	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7
		Rachel	Jacob			Brandon	Don			Brian	Andres		
D20	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7
		Isabella	Henry			Ye	Ethan			Michael	Nilesh		
C19	C18	C17	C16	C15	C14	C13	C12	C11	C10	C9	C8	C7	C6
Yang	Nicholas			Qingyang	Hesper			Thanh-Nha				Taggart	
B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Tyden	Anahita			Yiteng	Alexis			Eric	Tuan			Ziyan	Julian
								Qisen					Yuan
A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1

Row A = Yunyi, Liangchun, Zoe

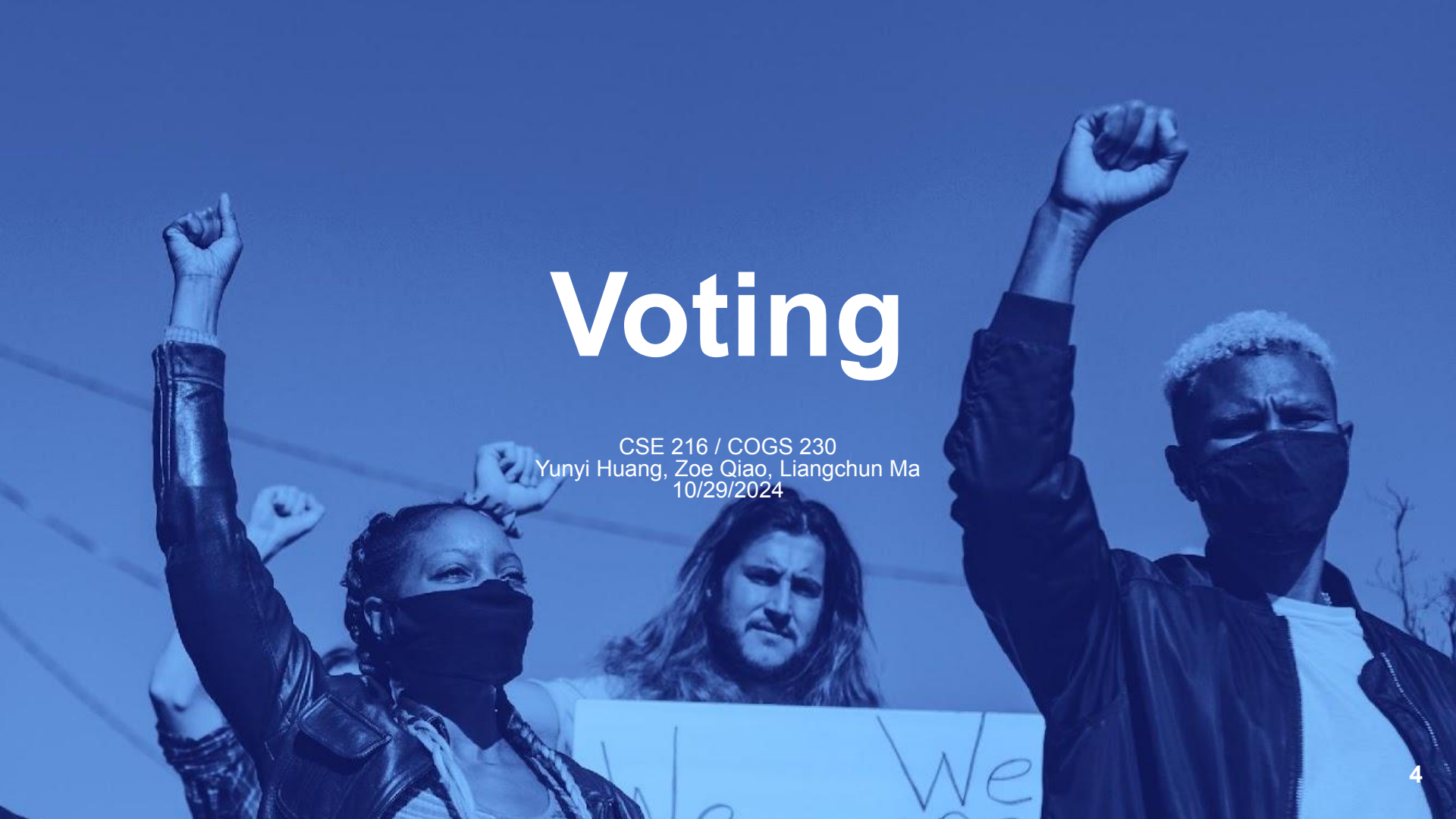
Announcements



Reading notes due Th 7am

No class or Office Hours on Tuesday
Nov 7th next week

Please come to class on time so you
can see and follow the seating chart

A blue-tinted photograph of a protest. In the foreground, a woman on the left and a man on the right are raising their fists. The woman is wearing a black face mask and a leather jacket. The man is also wearing a black face mask and a dark jacket. In the background, another person is visible holding a sign that partially reads "We".

Voting

CSE 216 / COGS 230
Yunyi Huang, Zoe Qiao, Liangchun Ma
10/29/2024

Making Voting Accessible: Designing Digital Ballot Marking for People with Low Literacy and Mild Cognitive Disabilities

Discussion lead: Liangchun Ma

This paper

- **Background:** Traditional ballot designs often overlook the needs of voters with low literacy or mild cognitive disabilities.
- **Objective:** Develop an accessible and responsive digital ballot interface that allows all users to vote successfully.
- **Significance:** As mobile devices may play a larger role in future elections, optimizing ballot designs for these platforms is essential.

Quick Summary

Research Question: How can we design a digital ballot that is intuitive and accessible to all voters?

Methodology: Two rounds of RITE (Rapid Iterative Testing and Evaluation)—one with paper prototypes and one with digital prototypes.

Key Findings: Simplified language and linear interaction improved the voting success rate, particularly for at-risk users.

Participants

Table I. Participant Data

Total Number of participants		26
Gender	Male	8
	Female	18
Age	18-35	7
	36-70	15
	70+	4
Ethnicity	Black	19
	Caucasian	5
	Hispanic	1
	Asian	1
Voting method in 2012 elections	Abstained	4
	Touchscreen	8
	Paper	14
REALM Score ^a	0-44 or 6 th grade or below reading level	3
	45-60 or 7 th -8 th grade reading level	6
	61-66 or 9 th grade or higher	17
Tablet familiarity	Familiar with tablets	5
	Unfamiliar with tablets	21

Table II. Participant Self-Reported Disabilities

	Paper Prototype Session	Digital Prototype Session
Difficulty Learning	1	2
Seizures	-	1
Physical Limitations	-	2
Serious Vision Issues	-	1 ^a
Difficulty Working	-	3

Discussion Question (1/3)

03:00

What are the potential biases introduced by testing with paper prototypes first, and how might these affect results when transitioning to digital interfaces?

Plain Language: Test Language to Ensure Usability

Issue: Complex instructions confused users, and ambiguous terms (e.g., "choices") led to misunderstandings.

Solution: Use simple, consistent, and positive language. Embed key instructions directly within tasks and bold critical phrases.

Outcome: Reduced confusion, improved accuracy, and better performance for low-literacy users.

Review Your Choices

This screen shows everything you voted for. Review it carefully.

Pay attention to any **red** area. **Red** means you did not vote or did not vote for as many candidates as you could.

To make changes

1. Touch the race you want to change.
2. At that race, if you have selected something before, touch the choice you do not want. That box will turn gray.
3. Then touch the choice you want.
4. To return to this screen, touch **Return to Review**.

If you are ready to cast your ballot, touch **Ready to Cast Ballot**.

Ready to Cast Ballot

President and Vice President

Elizabeth Harp and Antoine Jefferson

US Senate

David Platt

US Representative

Carrol Forrest

Governor

Alex Wallace

Lieutenant Governor

George Hevis

Registrar of Deeds

(ALBERT STERNER)

State Senator

Andrea Solis

State Assembly

Edward Shipett

County Commissioners

Valen Altman, John White, Helen Moore

City Council

Donald Rupp, Barbara Shry, Carole Smith, Harvey Barker

Water Commissioners

Gregory Seldon, Orville White

Court of Appeals Judge

Kenneth Mitchell

Retention -- Chief Justice

Yes

Retention -- Associate Justice

Yes

Constitutional Amendment K

For

Ballot Measure 101

Against

Ballot Measure 106

For

Back

?

Next

Figure 4. Redish, et al. (2009) recommended thorough and complete instructions in plain language.

Plain Language: Make It Look Easy to Read

Issue: Lengthy instructions intimidated users and increased cognitive load.

Solution: Minimize text length, use larger fonts, and bold key phrases to highlight essential actions.

Outcome: Users felt less overwhelmed, leading to smoother interactions and higher confidence.

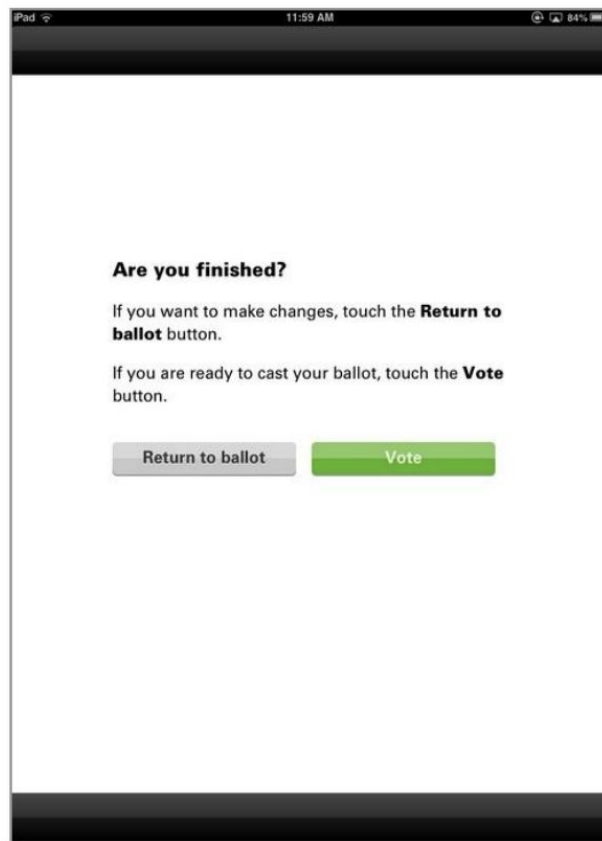
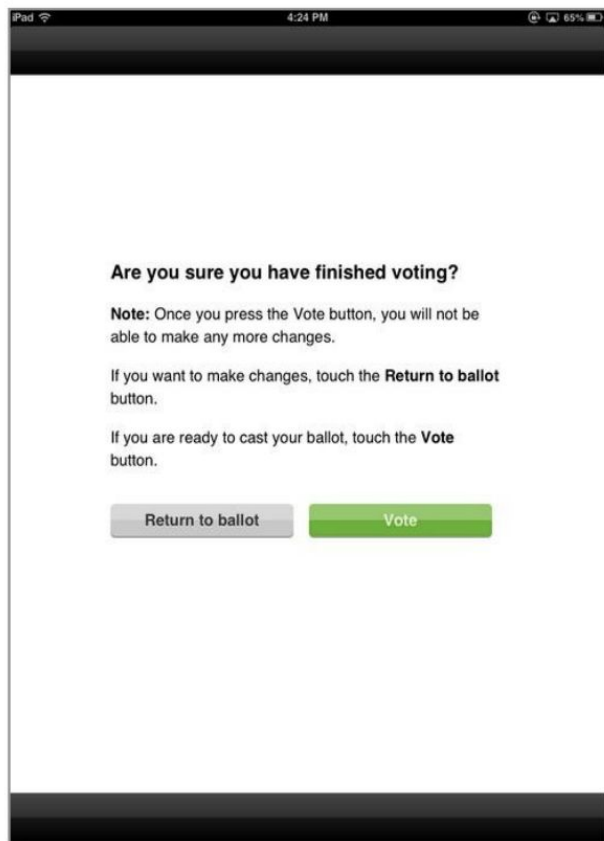


Figure 6. The early version of the confirmation screen on the left triggered anxiety for some voters. They responded as if it were an error message, and worried that they had somehow made a mistake. The final version on the right reassured voters that they were proceeding as planned, but allowed them to return to the ballot if they still wanted to make changes.

Discussion Question (2/3)

03:00

What are some real-world examples where plain language improves accessibility and usability (e.g., public signage, healthcare instructions)?

Plain Interaction: Support Users' Preferred Actions

Issue: Some users struggled with gestures and touch interactions, while others relied heavily on them.

Solution: Provide multiple ways to interact (e.g., buttons, scrollbars, swipes) to accommodate various preferences.

Outcome: Users completed tasks more effectively when they could use their preferred interaction methods.

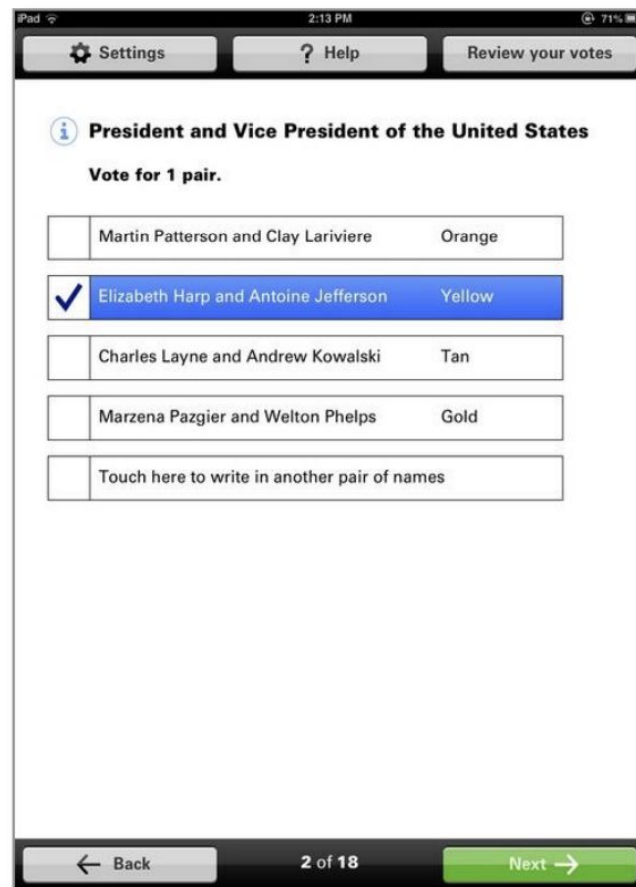
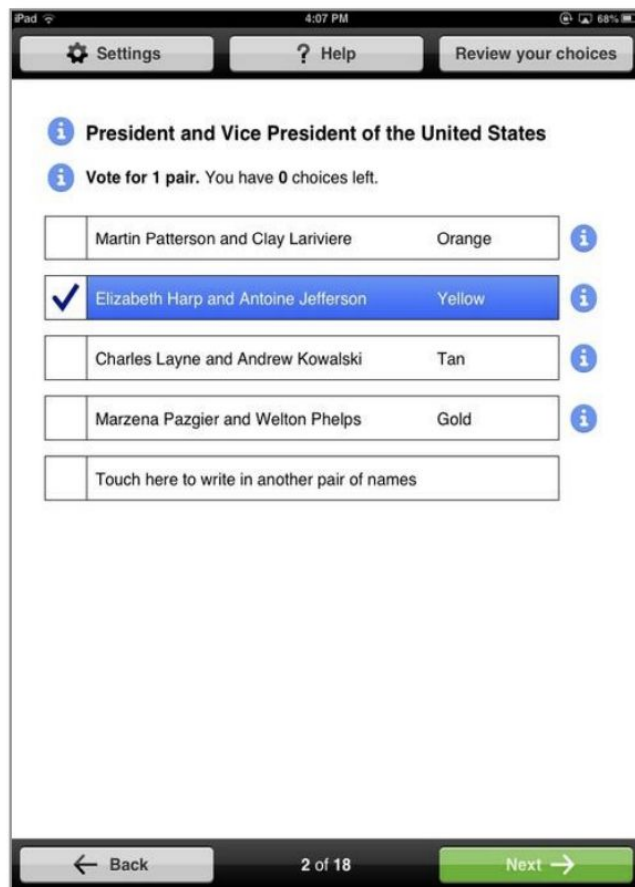


Figure 7. Ballot before and after removing extra icons

Discussion Question (3/3)

03:00

What potential challenges might arise from adding more interaction methods (e.g., voice input, gesture control), and how can we balance user flexibility with system simplicity?

Plain Interaction: Support Immediate Action

Issue: Separating instructions from actions led to hesitation and errors.

Solution: Integrate instructions directly into the action flow and use a portrait layout to align tasks linearly.

Outcome: Improved task flow, with users acting confidently without delays.

Help

To vote for the candidate of your choice, touch that person's name. The box will turn blue.



If you want to change a vote or if you make a mistake, first touch the blue choice you no longer want. It turns white again. Then touch the choice you do want.

To write in a candidate: To vote for a person who is not on the ballot, touch "Touch here to write in a name." You will get more instructions on how to complete your write-in.

You do not have to vote in every race. Your ballot will still be counted even if you do not vote in every race.

You can find more information by touching the  near where you need help.

Close

How to vote

To vote for the candidate of your choice, touch that person's name. The box will turn blue.

To write in a candidate: To vote for a person who is not on the ballot, touch "Touch here to write in a name." You will get more instructions on how to complete your write-in.

If you want to change your vote or if you make a mistake, first touch the blue choice you no longer want. It turns white again. Then touch the choice you do want.

You do not have to vote in every race. Your ballot will still be counted even if you do not vote in every race.

← Back

Next →

Plain Interaction: Create a Linear Flow

Issue: Users were confused by non-linear navigation, especially after leaving the review screen.

Solution: Implement "out-and-back" navigation from review to specific ballot sections and back, providing a clear path.

Outcome: Users navigated ballots more easily, reducing errors and improving completion rates.

[Settings](#)[Help](#)[Review your votes](#)

County Commissioners

Vote for up to 5. You can choose **2** more.

↑ Touch to see more names ↑

☐	Damian Rangel	Orange
☐	Mary Tawa	Orange
☐	Sheila Moskowitz	Orange
☒	Helen Moore	Yellow
☒	John White	Yellow
☒	Valarie Altman	Yellow

↓ Touch to see more names ↓

[Return to review and cast your vote →](#)

Key Takeaways

Simplified Language and Interaction: Reduced cognitive load, ensuring critical information is easy to grasp.

Improved User Engagement: Accessible design benefits not just disabled users but also enhances usability for everyone.

Future Work: Further testing in real elections and customization options (font size, contrast) are needed.

Can Voters Detect Malicious Manipulation of Ballot Marking Devices?

Bernhard et al., 2020
Discussion lead: Yunyi

Recent news



Voting machines can be vulnerable.

Ballot Marking Devices (BMDs)

- **How they work**

- Voters select candidates on a computer
- A paper ballot is printed for review and submission

- **Pros**

- Provides a paper trail
- Better security than fully electronic systems

- **Cons**

- Vulnerable to malware infections – misprinting attack
- Relies heavily on voter verification





This paper

- **Goal**

- To evaluate how effectively voters can detect errors on printed ballots from BMDs
- To determine whether the verification performance can be improved by procedural changes

- **Motivation**

- BMDs offer a paper trail, but voter failure to check printouts could allow errors to go unnoticed, risking election integrity

- **Approach**

- The researchers introduced errors on ballots in a mock election with 241 participants and tested interventions (e.g., verbal prompts, slates) to see if error detection improved

Human-Dependent Security

- BMDs relies on voters verifying printed ballots
- Verification errors happen after voters finish making selections
- Effective security requires clear, timely, and motivating warnings/prompts
- Interaction design can help by using simple, direct prompts

Discussion Question (1/3)

03:00

- What design strategies could be used to make voters more likely to verify their ballots?

Effectiveness of Verbal Prompts

- Verbal prompts improved ballot verification
- Prompts work better when they interrupt the task flow
- Timely, clear prompts help guide voter behavior

Discussion Question (2/3)

03:00

- Why are verbal prompts more effective than signage in prompting users to verify ballots?
- How can prompts be leveraged in other contexts to encourage user behavior?

Use of Slates for Voting

- Slates
 - Pre-filled lists of candidates given to voters before they use BMDs
 - Improved error detection
- External aids can help users perform complex tasks
- Designers should consider using aids to guide user decisions

Design for Accessibility

- Verifying ballots on BMDs can be hard for visually impaired users
- Accessible design should include large text, tactile feedback, and audio prompts
- Design must balance ease of use and security for all voters

Discussion Question (3/3)

03:00

- What role do designers play in system integrity?
- Specifically, are designers responsible for prompting users to check for errors? If designers don't prompt users for errors, could they be at fault for any issues that happen as a result?

Key Takeaways

- Voter verification is crucial but often overlooked
- Prompts and external aids like slates can boost verification rates
- Design must balance accessibility and security for all users
- Effective interaction design can make a significant impact on election security

Investigating Voter Perceptions of Printed Physical Audit Trails for Online Voting

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discussion lead: Zoe Qiao

DISCUSSION AGENDA

Recap:

- Summary

Discussion Topics:

- Motivation for Hybrid Online Voting
- User Study Design and Methodology
- Findings on Trust, Security, Usability
- Challenges in Implementation



SUMMARY

Goal:

- Investigating how integrating different physical audit trails into online voting systems affects voters' perceptions of security, trust, usability, and overall user experience.
- Identify Implementation Challenges.

Approach:

- Systematic comparison between a standard online voting system and two hybrid models incorporating physical audit trails.
- Combining quantitative and qualitative data, provide empirical evidence on whether physical audit trails can address security and trust concerns without negatively impacting usability.

Online Voting...

Benefits:

- **Convenience:** Voters can cast their ballots from anywhere with internet access.
- **Accessibility:** It can make voting easier for people with mobility issues or those living far from polling stations.
- **Faster Results:** Electronic tallying can speed up the counting process.

Challenges:

- **Security Risks:** Ensuring that votes are cast and counted accurately without interference from malicious actors is a major concern.
- **Voter Trust:** Without a physical record, voters may doubt whether their votes are being properly recorded and tallied.
- **Lack of Physical Audit Trails:** Traditional paper ballots provide a tangible way to verify election results through audits, this is missing in fully digital systems.

Motivation for Hybrid Online Voting

By integrating physical audit trails into online voting systems, the authors aim to:

- **Enhance Security:**
Provide a physical record that can be audited to ensure vote integrity.
- **Increase Trust:**
Allow voters to observe the creation of a physical representation of their vote, boosting confidence.
- **Improve Transparency:**
Offer verifiable evidence votes are recorded & stored securely.
- **Combine Benefits:**
Merge the convenience of online voting with the security features of traditional paper-based systems.

HOW TO VOTE?

Step 1

Visit the Official Election Website

The voter navigates to the official online voting website.

Step 2

Casting the Vote

The voter makes their selections by clicking or tapping on their chosen options, review, and then submit.

Step 3

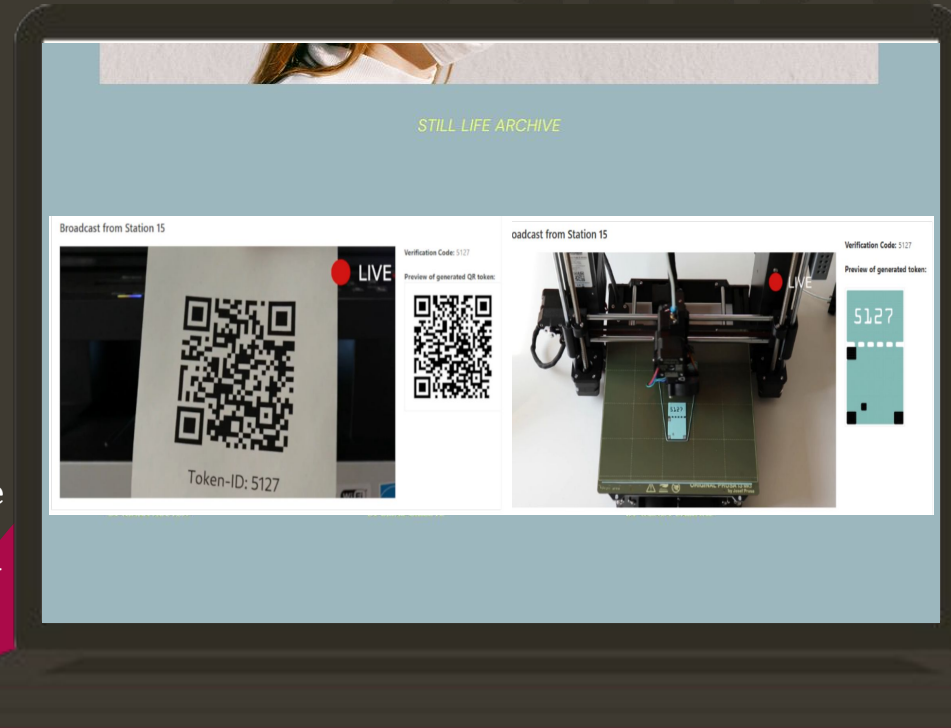
Generation of Physical Audit Trail

Includes a QR code or barcode encoding the encrypted vote. / A 3D printer produces a physical token encoding the vote.

Step 4

Live Broadcast of the Process

The voter is provided with a live video stream of the printing & depositing(into a sealed box) ballot process





Discussion Question (1/4)

03:00

- How might integrating physical audit trails address these security challenges?
- Would the addition of physical audit trails increase your trust in an online voting system? Why or why not?

User Study Design and Methodology

User study

- 150 participants were randomly assigned to one of three conditions(Baseline or paper/3d token trail as pre recorded videos).
- Examine how integrating physical audit trails into online voting systems influences voters' perceptions of security, trust, usability, and user experience.

Standardized questionnaires & qualitative feedback

- Security Readiness Scale (SRS), Human-Computer Trust Model (HCTM)
- System Usability Scale (SUS), User Experience Questionnaire (UEQ)
- Interaction Vocabulary (IV).
- Open-ended Questions.

The data were analyzed...

- to compare perceptions across the conditions
- extract deeper insights from the qualitative comments.



Discussion Question (2/4)

03:00

- What are the advantages and limitations of using a between-subjects design in this study?
- How might the use of pre-recorded videos instead of real-time printing affect the study's findings?



Findings on Trust, Security, Usability

Investigating Voter Perceptions of Printed Physical Audit Trails for Online Voting

	Trust	Security	Usability
Baseline	Lower trust due to the lack of physical evidence.	They didn't find statistical evidence that trails decrease	Rated highly for ease of use.
Paper Audit Trails	Enhanced trust level compared to baseline.	security. 3D-printed tokens perceived as	Not negatively impact usability.
3D-Printed Tokens	Mixed results on trust levels.	more secure in terms of vote secrecy.	Decreased usability due to complexity and longer process.



Discussion Question (3/4)

03:00

- Why might participants have perceived paper audit trails as more trustworthy than baseline system?
- How do these findings inform the design of future online voting systems?

Challenges in Implementation

Secure Facilities:

- Setting up printers in secure physical locations is complex.
- Additional needs like energy supply and staff.

Vote Secrecy vs. Verifiability:

- Tension between let voters verify their votes and maintaining secrecy.
- Printing clear text aids verification but compromises privacy.
- Code voting protocols enhancing security without violating privacy, but complicate the system and affect usability.

Understandability:

- The system needs to be user-friendly for both voters and poll workers. Also, Poll workers can affect voter trust.
- Different tallying methods have trade-offs between efficiency and transparency.

Scalability:

- High voter turnout could overwhelm printing resources, cause delays.
- Simultaneous process needs further research to optimize.



Discussion Question (4/4)

03:00

- How can election authorities balance the need for security with the importance of usability?
- What strategies could be employed to educate voters about hybrid online voting systems?

Key Takeaways

Hybrid Online Voting: Offers a promising solution to enhance security and trust in online voting by integrating physical audit trails.

User Perceptions Matter: Familiarity and ease of use significantly impact voter acceptance of new technologies.

Practical Implementation: Real-world challenges such as scalability, security, and voter education must be carefully addressed.



Activity

You have been paid to consult with the San Diego registrar of voters. In previous years, they had a problem where 1) poll workers would not set up all the poll stations they were given, 2) voters were taking in a live ballot into the polling station and 3) electioneers were standing at the entrance of various polling stations.

With the people around you, pick one problem and provide a design solution for the issue.