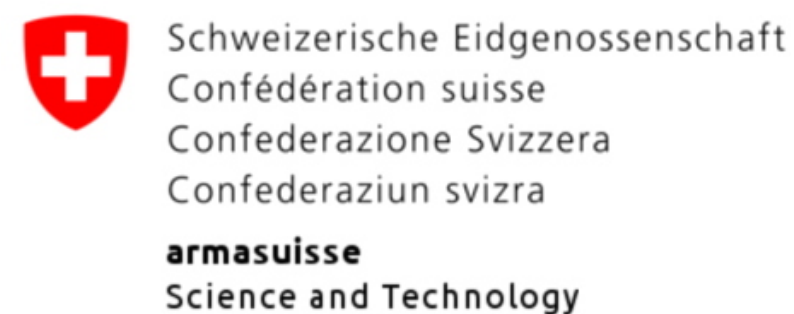
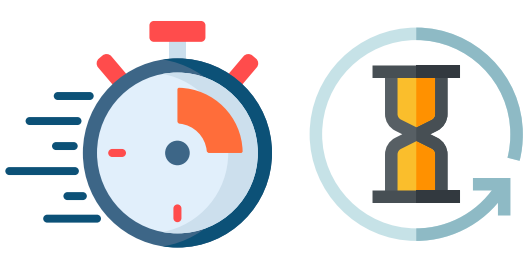


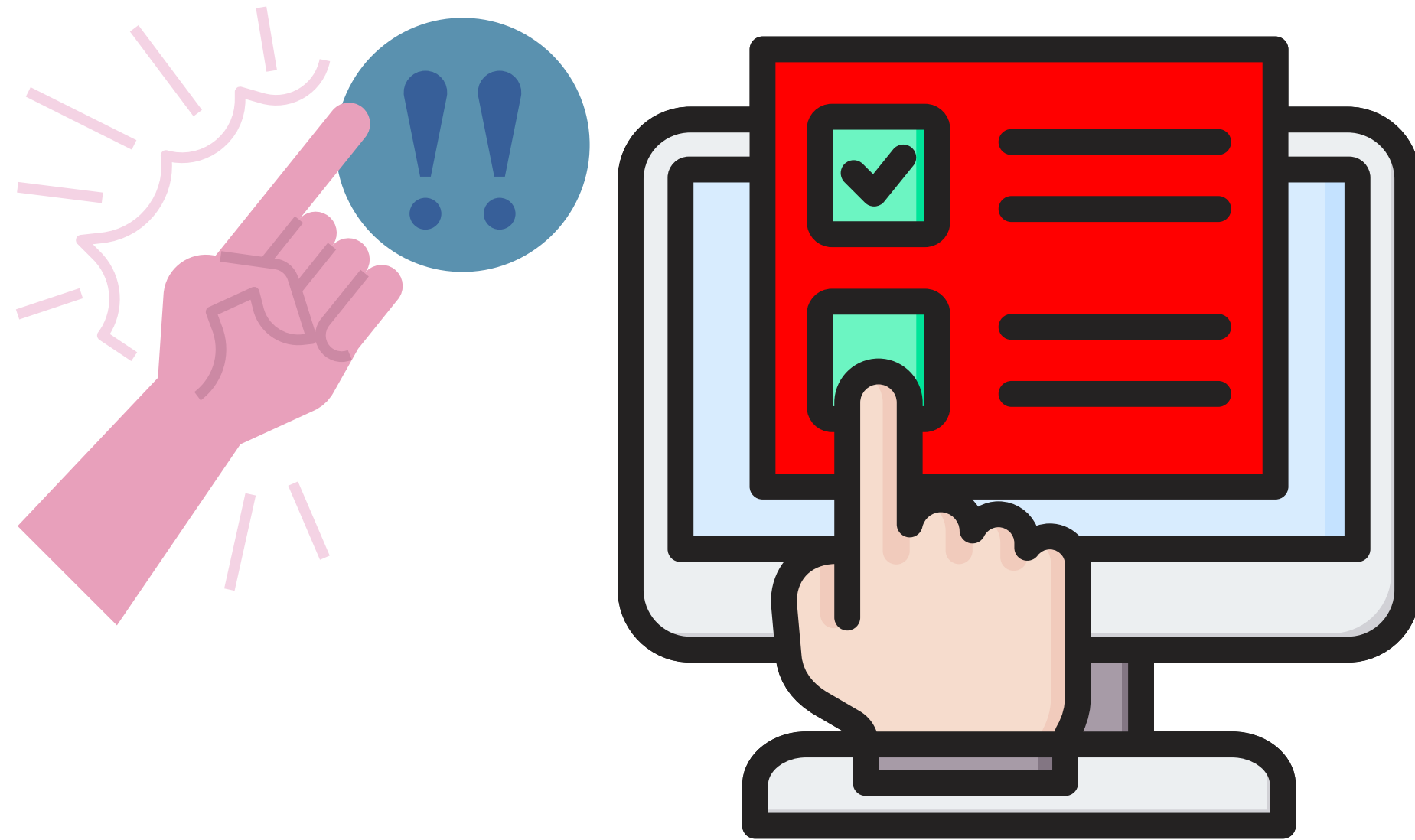
E-Vote Your Conscience: Perceptions of Coercion and Vote Buying, and the Usability of Fake Credentials in Online Voting

Louis-Henri Merino, Alaleh Azhir, Haoqian Zhang, Simone Colombo,
Bernhard Tellenbach, Vero Estrada-Galiñanes, Bryan Ford

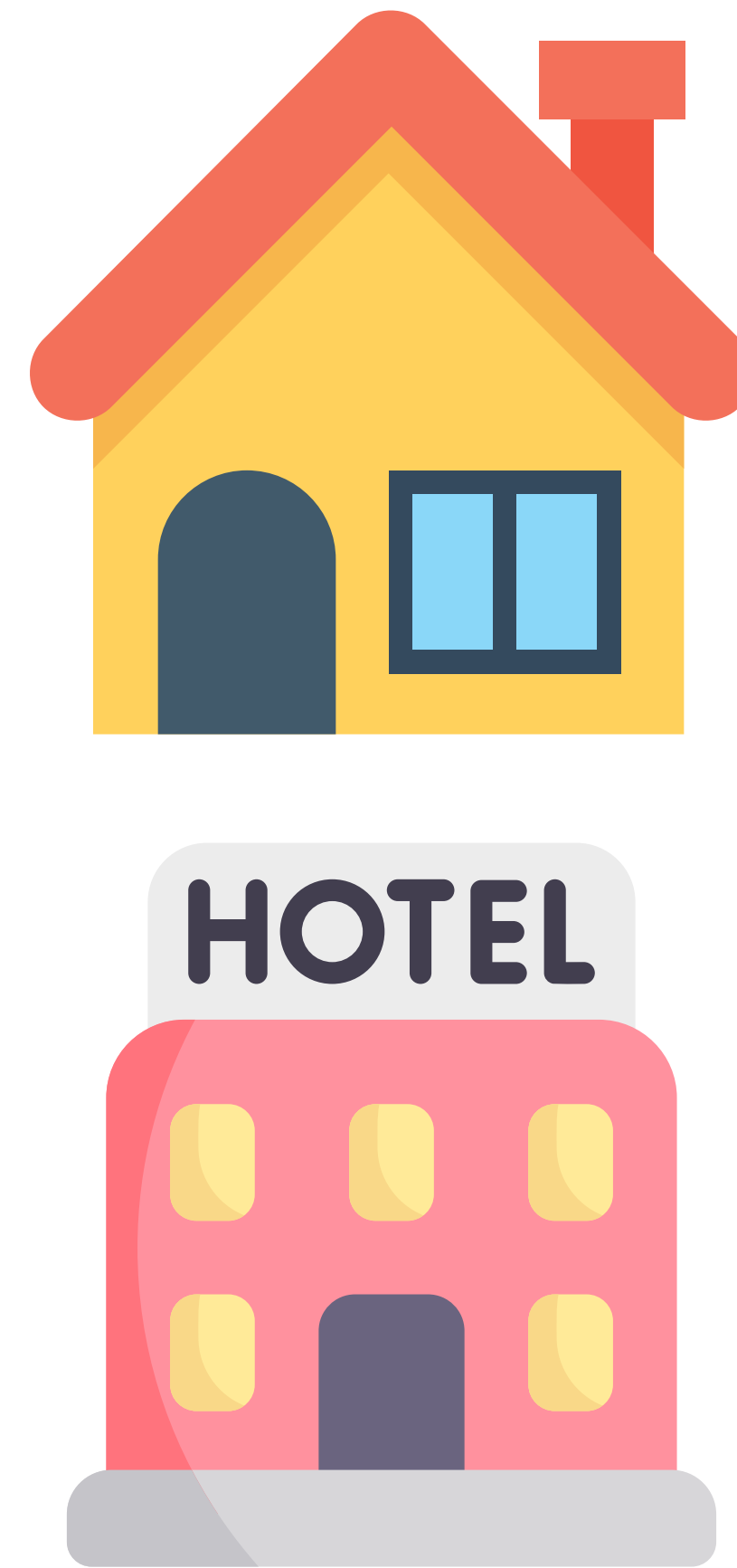




Online Voting

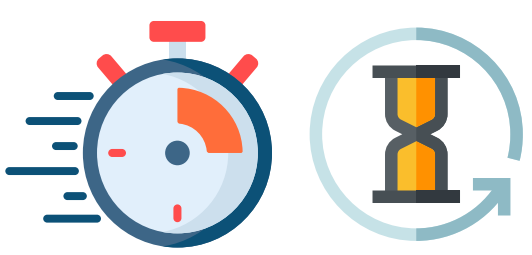


Cast your vote anywhere



Home

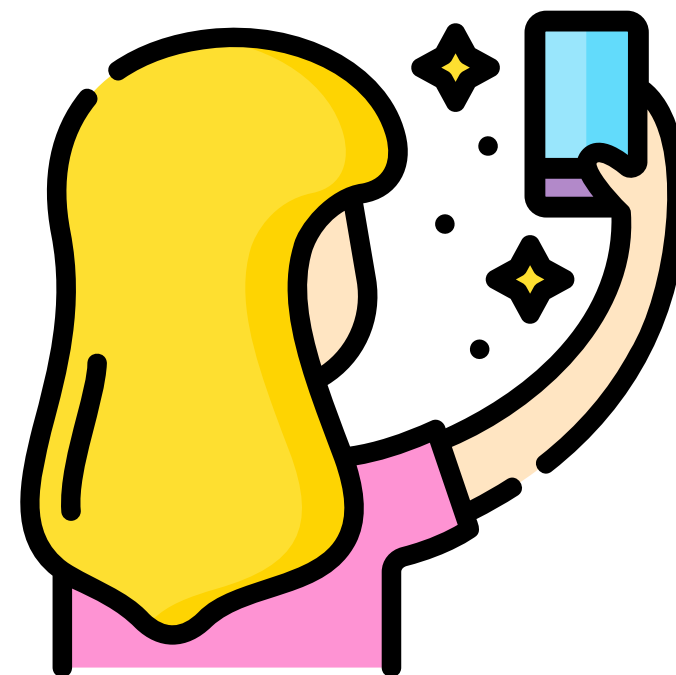
Hotel



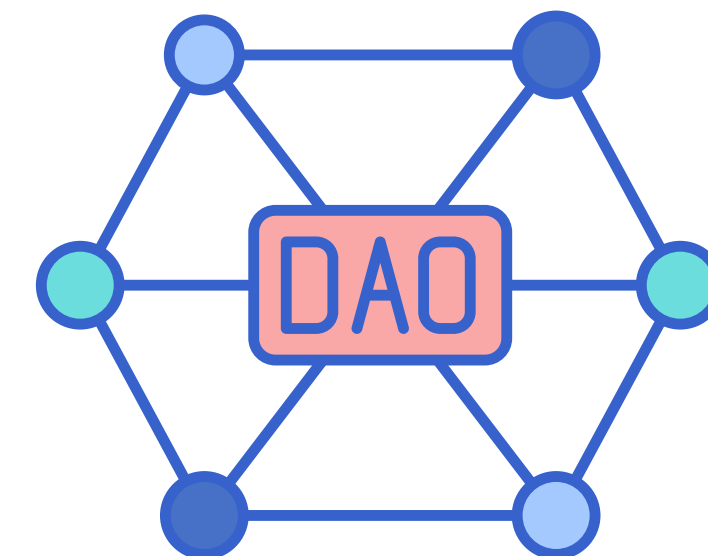
Coercion in E-Voting



Forceful

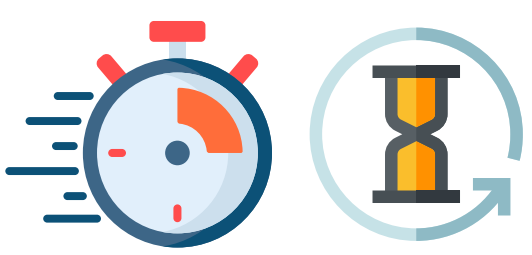


Vote-Buying Selfie



“Dark” DAOs¹:
Vote Buying at Scale

1. Austgen, James, et al. *DAO Decentralization: Voting-Bloc Entropy, Bribery, and Dark DAOs*. arXiv:2311.03530, 6 Nov. 2023.



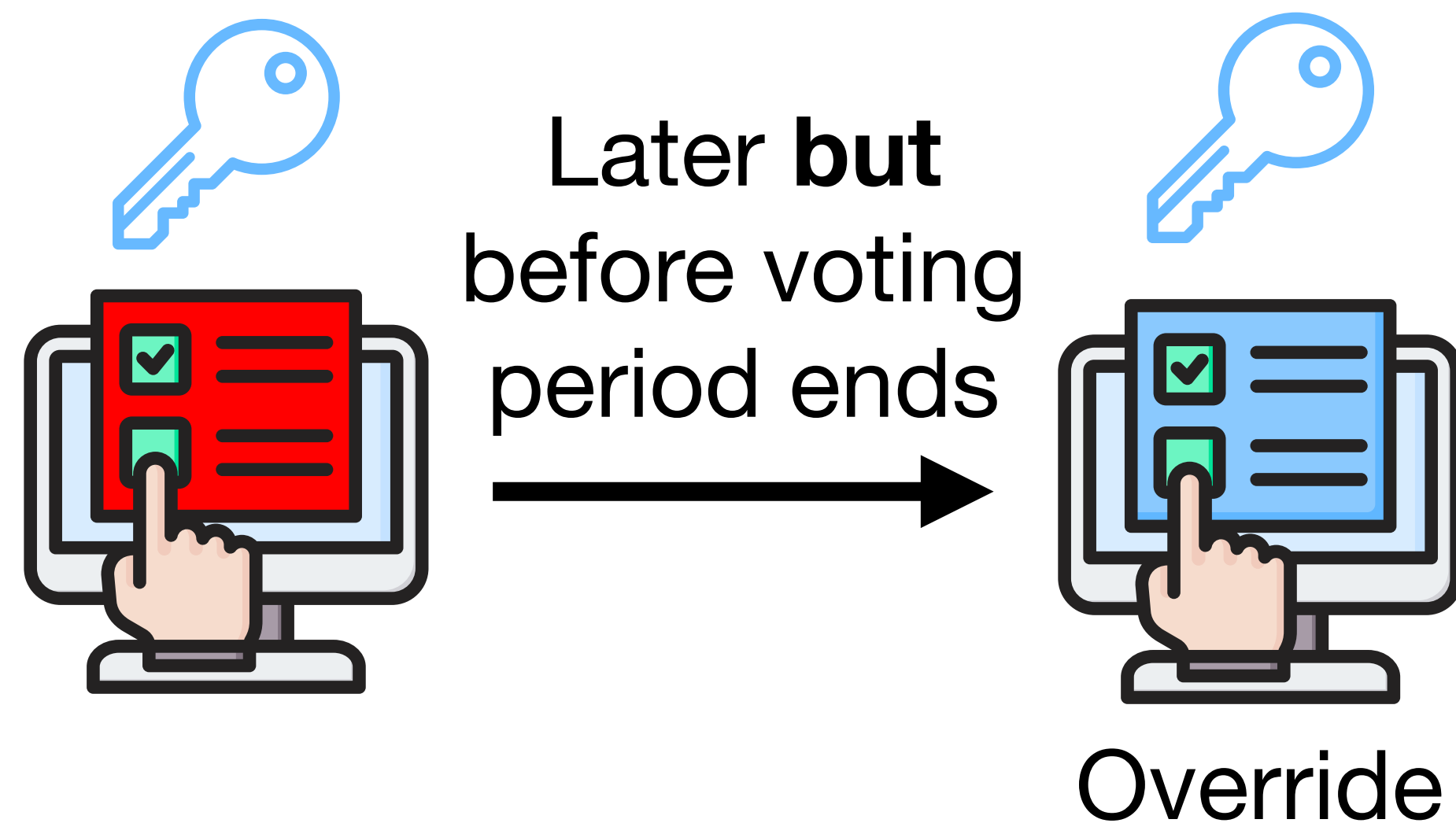
Roadmap

- **The Coercion-Resistance Challenge**
- TRIP Registration Scheme
- User Study Design
- User Study Results
- Limitations and Conclusion

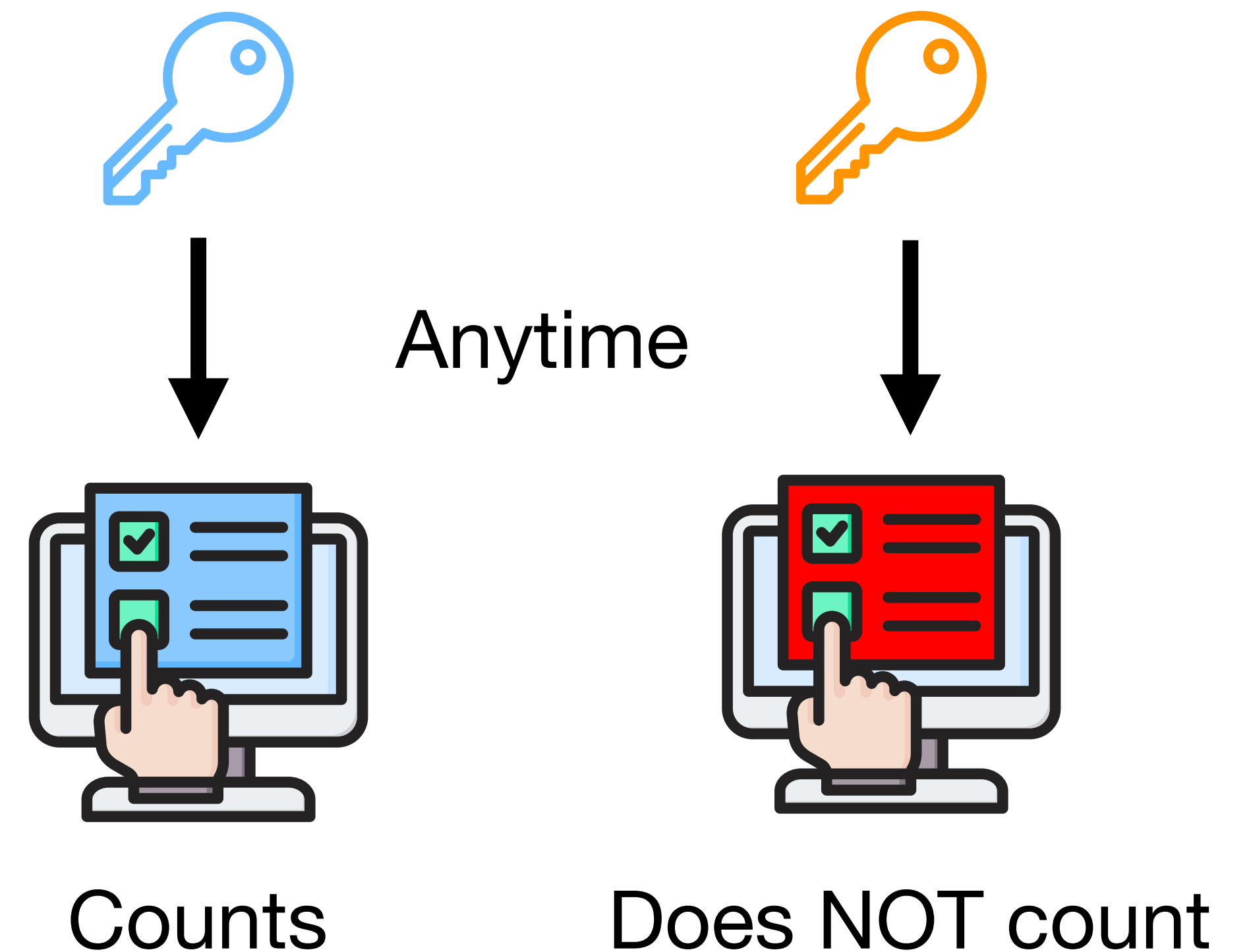


Coercion-Resistant Strategies¹

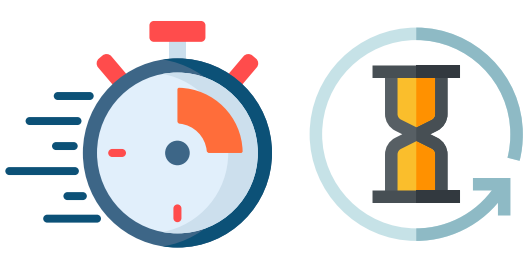
Deniable Re-Voting



Fake Credentials



1. Kulyk, Oksana, and Stephan Neumann. "Human Factors in Coercion Resistant Internet Voting—A Review of Existing Solutions and Open Challenges." *Proceedings of the Fifth International Joint Conference on Electronic Voting*, 2020



Many Fake Credentials!

Real



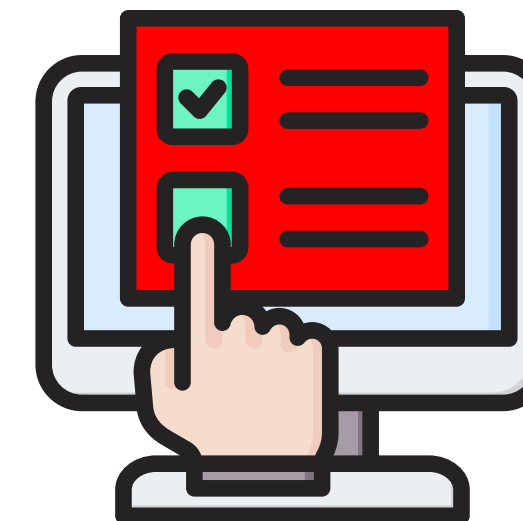
Fake

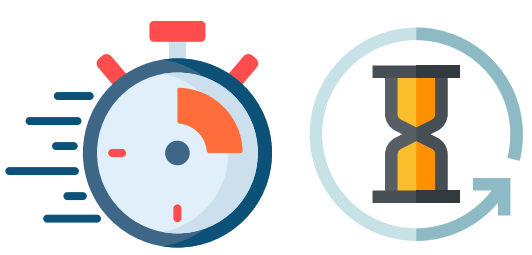


Fake

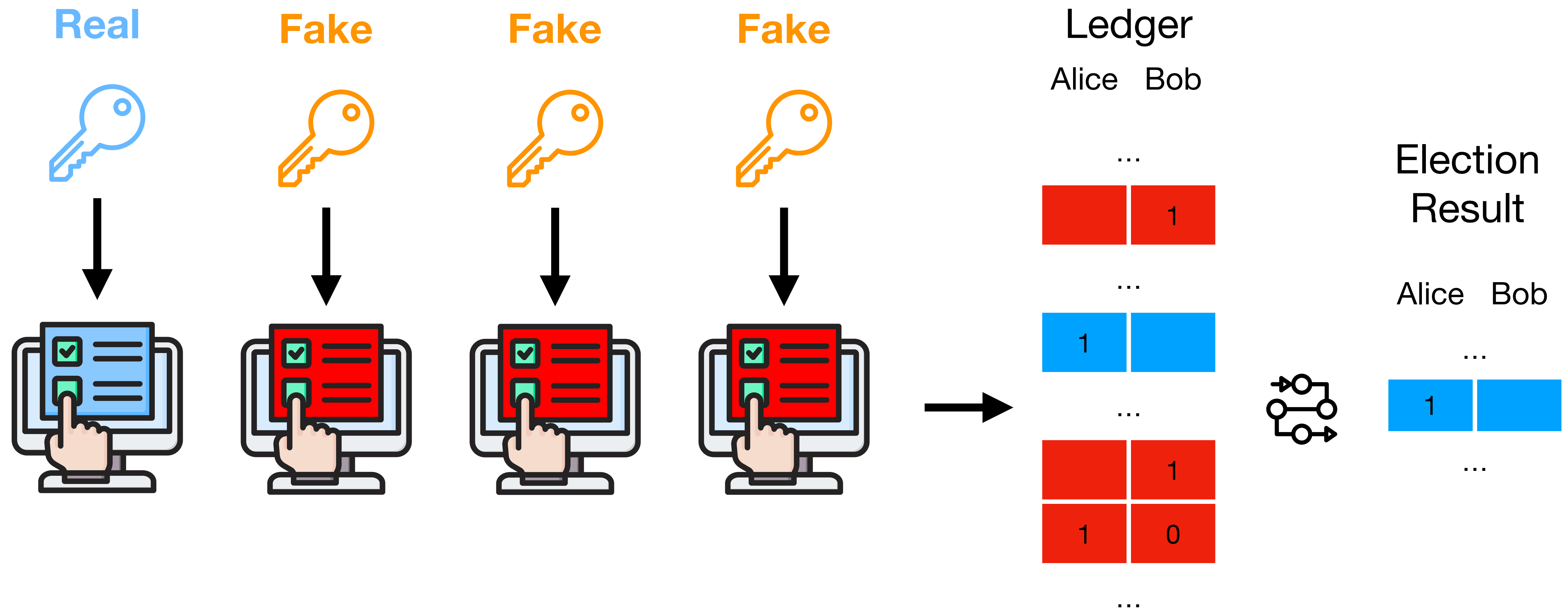


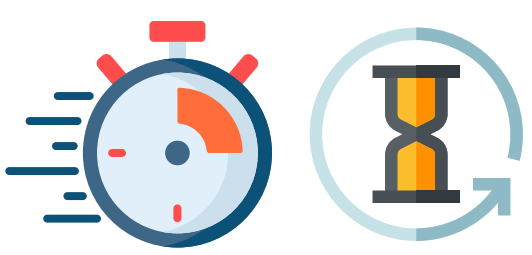
Fake





Many Fake Credentials!

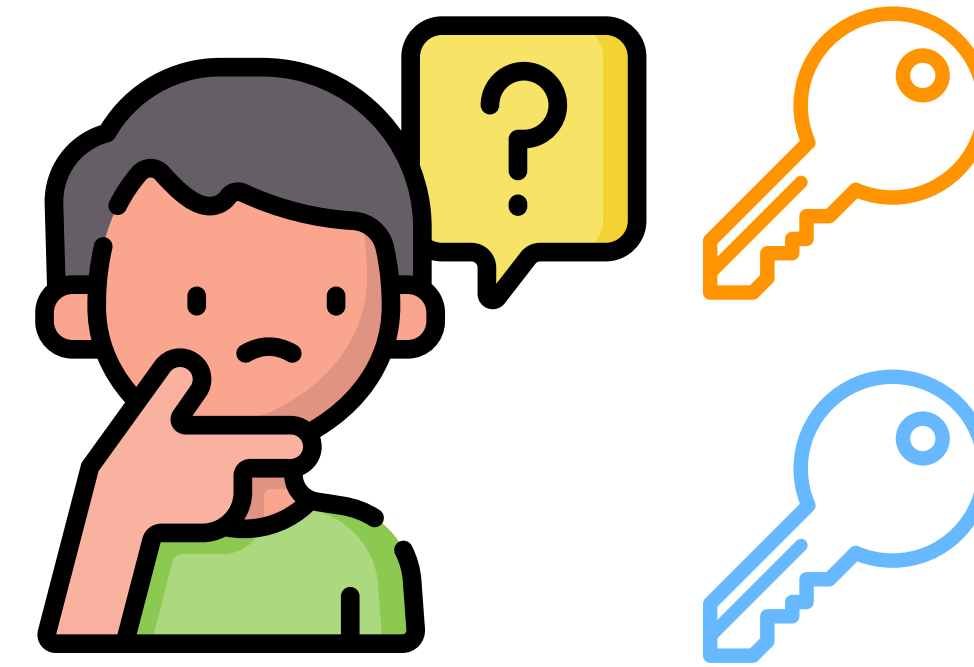




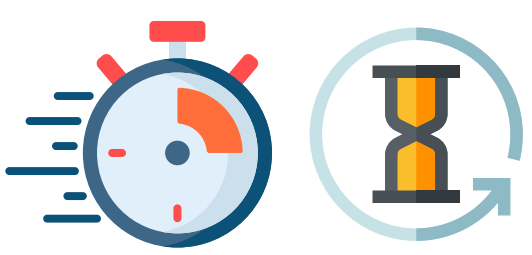
Usability Concerns with Fake Credentials



Comprehend?

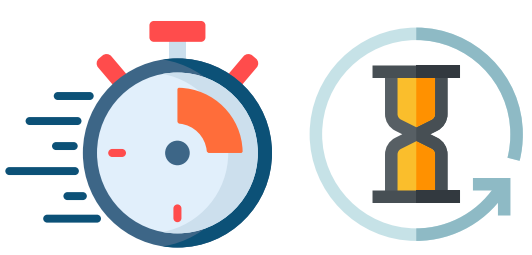


Real or Fake Credential?

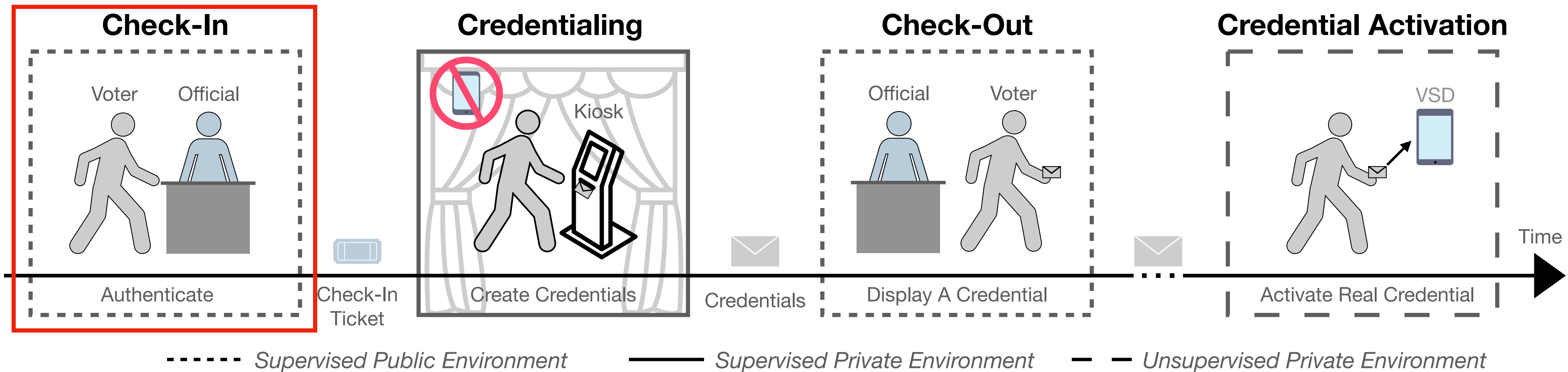


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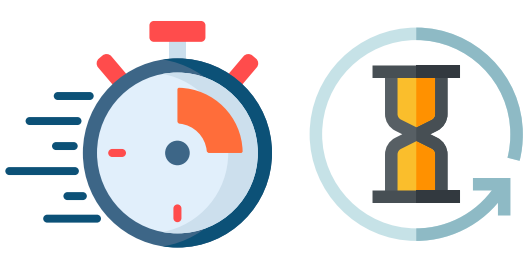


Trust-Limited Coercion-Resistant In-Person Registration Scheme¹

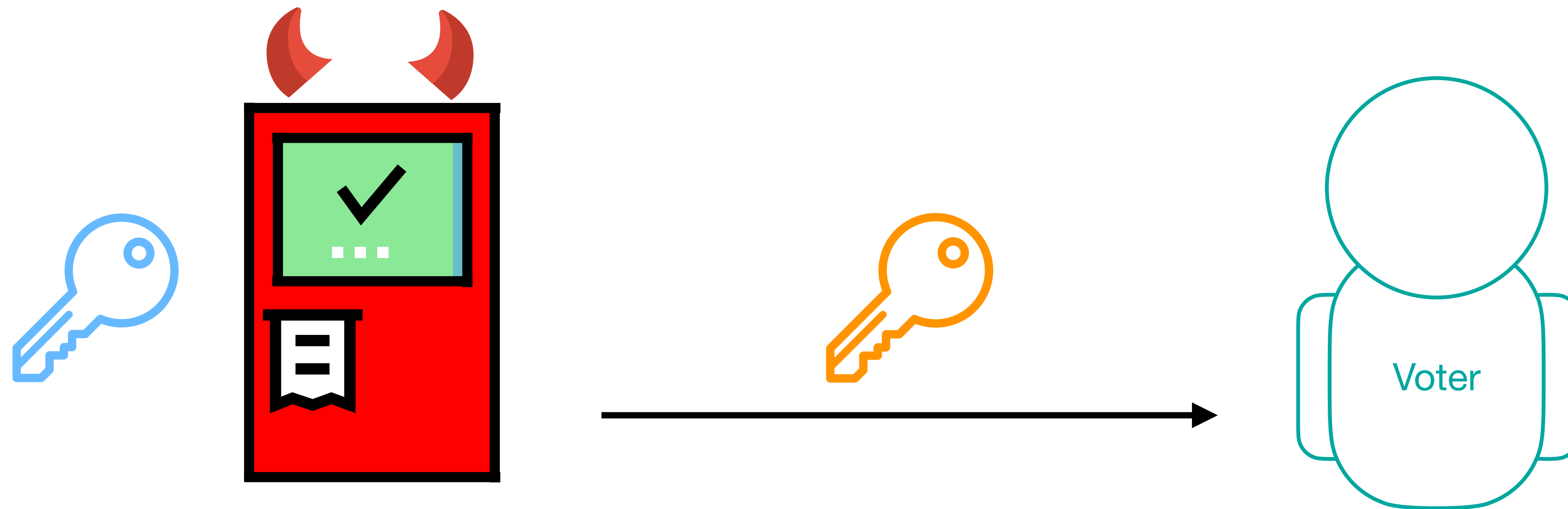


TRIP issues voter-verifiable **real credentials** and indistinguishable **fake credentials**

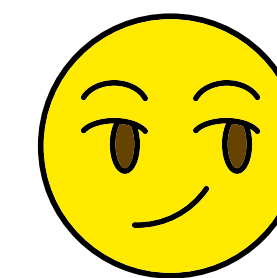
1. Merino, Louis-Henri, et al. *TRIP: Trust-Limited Coercion-Resistant In-Person Voter Registration*. arXiv:2202.06692, arXiv, 17 Mar. 2024



Voter Verifiable Issuance?



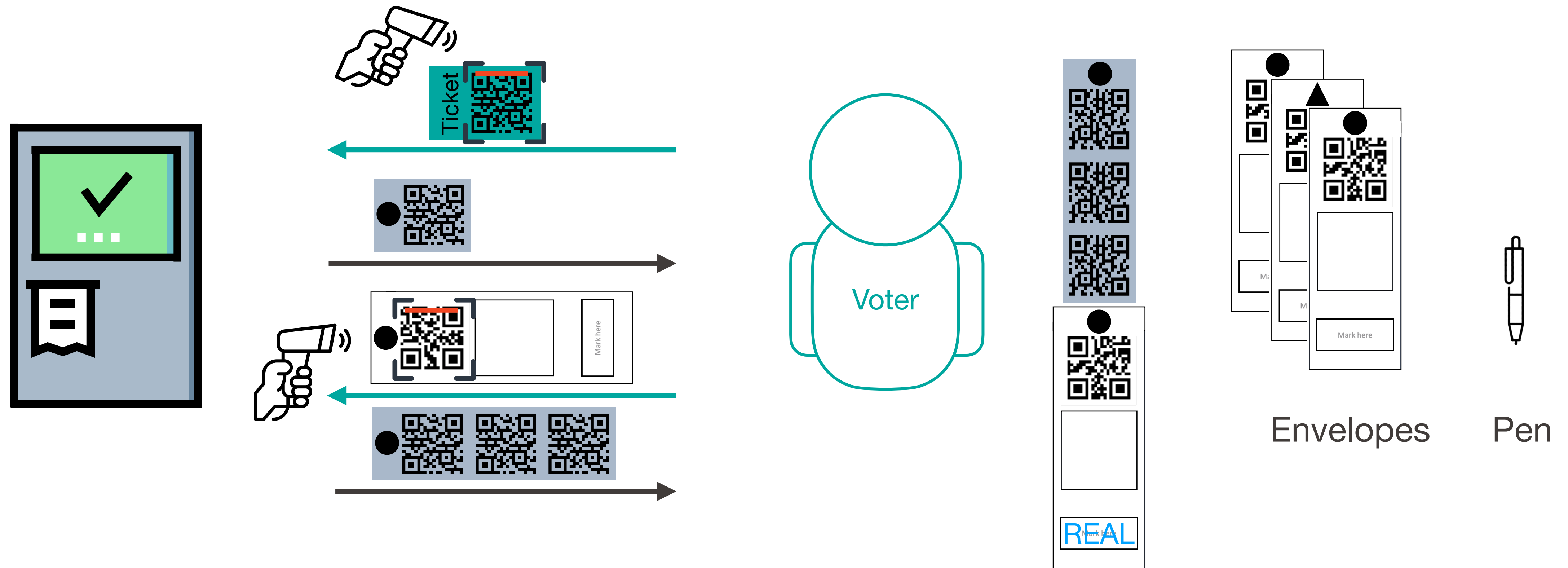
Here is your real credential





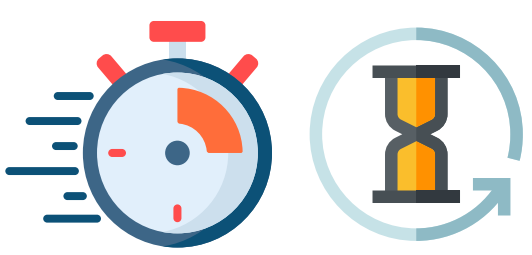
Real Credential Creation Process

(with an interactive zero-knowledge proof)



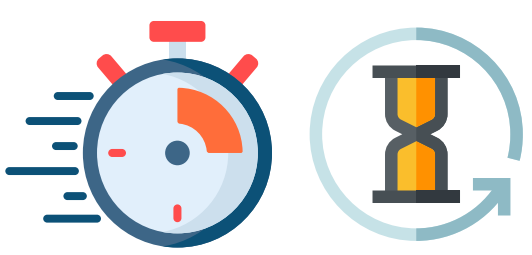
Voter **presents** envelope after kiosk prints **first** QR code





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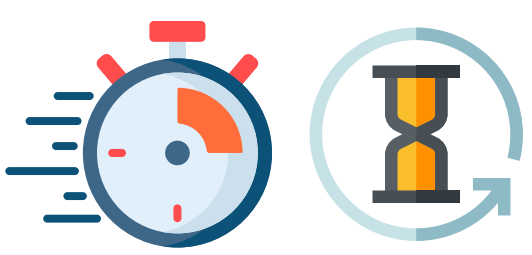


Study Flow & Location

1. Enrollment
2. Instructional Video
3. **TRIP Registration**
 1. Check-In
 2. Credentialing
 3. Check-Out
 4. Activation
4. **Voting**
5. Study Survey

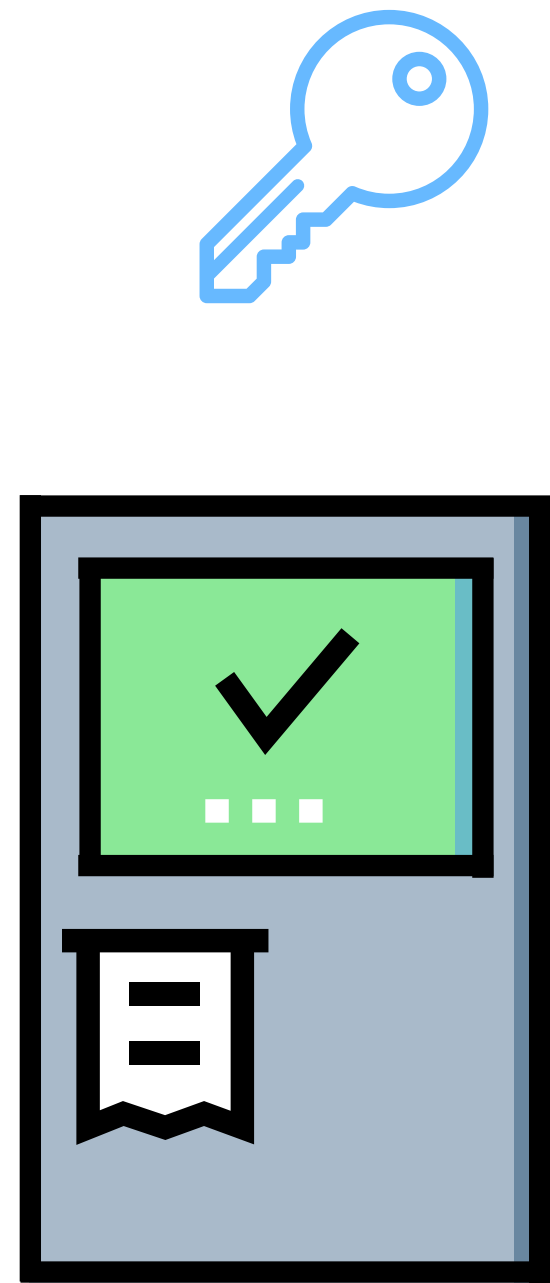


Suburban Park of Boston, MA



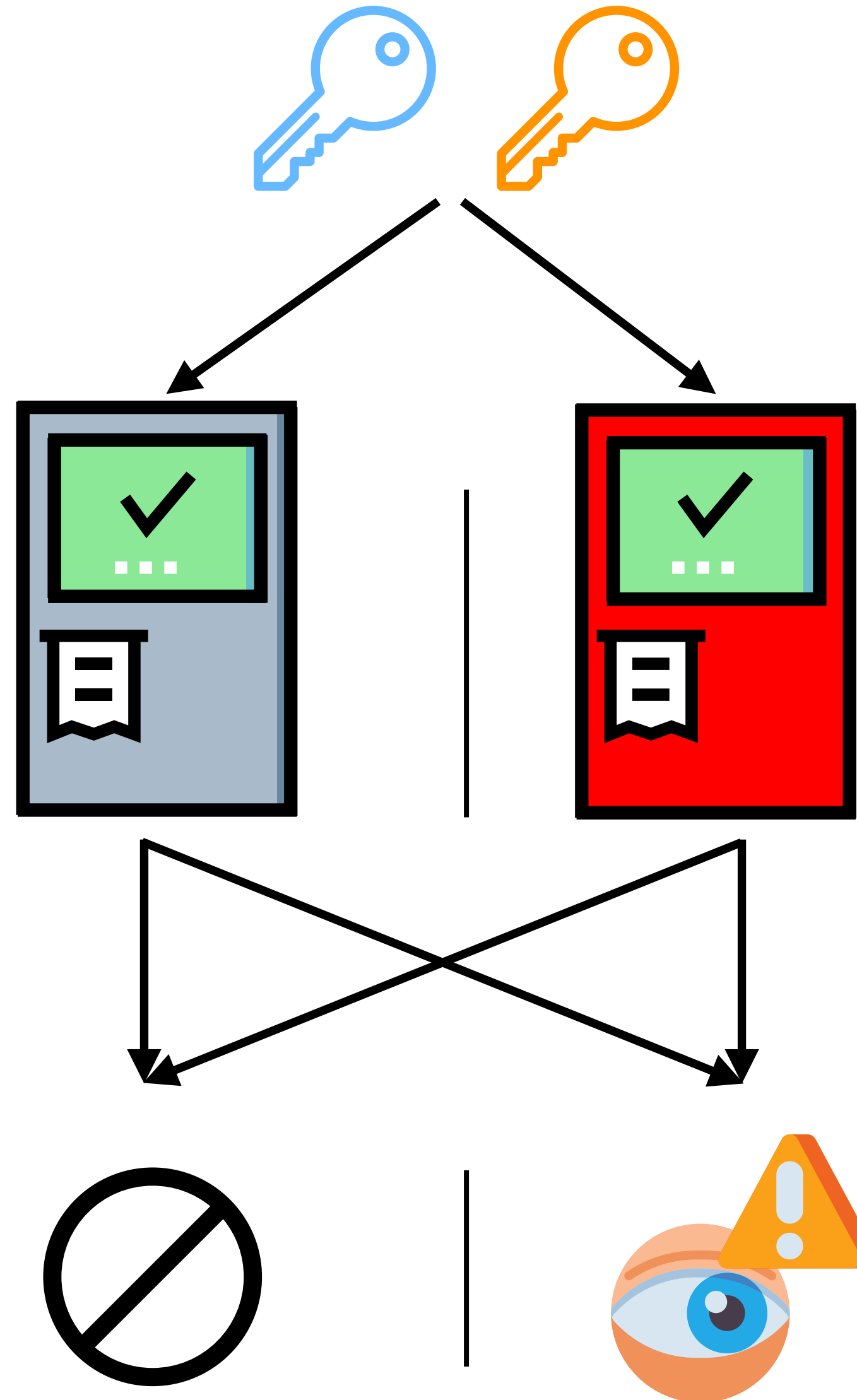
5 Study Groups

Control Group



Fake Credentials

**Honest OR
Malicious Kiosk**



**With OR Without
Security Priming**



5 Study Groups

	Honest Kiosk	Malicious Kiosk
Real Credential <u>Only</u>	Group C	
Test Credentials	Group F 	Group M

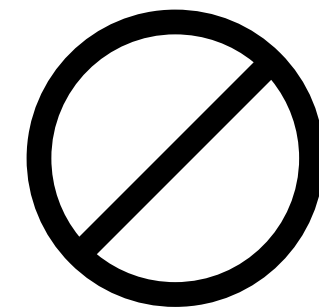
Intended Deployment in Reality

	Honest Kiosk + <u>Security Priming</u>	Malicious Kiosk + <u>Security Priming</u>
Test Credentials	Group <u>S</u> F	Group <u>S</u> M



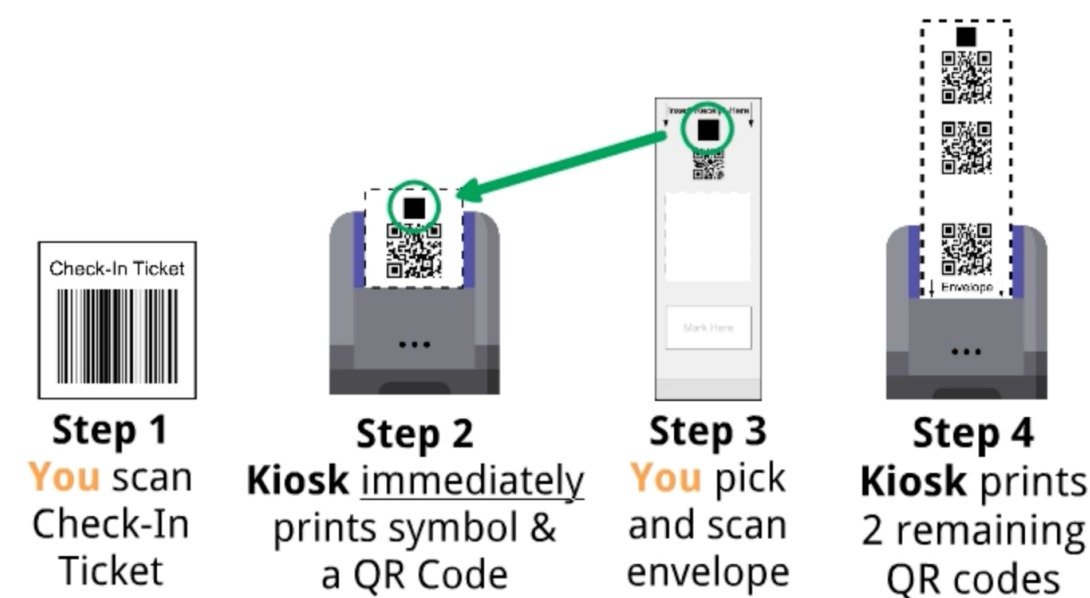
Security Priming?

Without Security Priming
Groups F & M



DISTINGUISHING CREDENTIALS

Real Credential



Test Credential



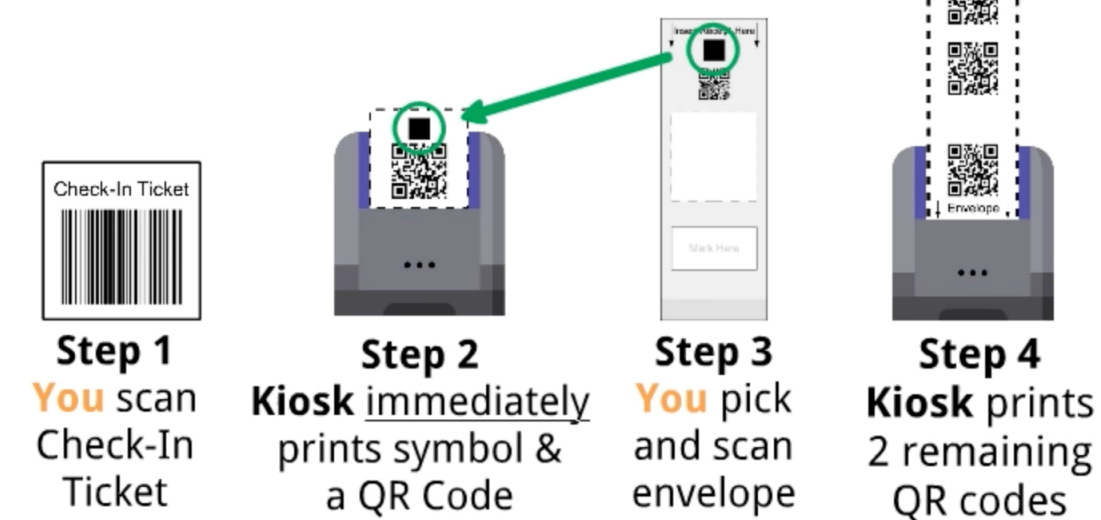
Intended deployment:
“positive vibe” but less instructive



With Security Priming
Groups SF & SM

BEWARE DETECTING A HACKED KIOSK Real Credential

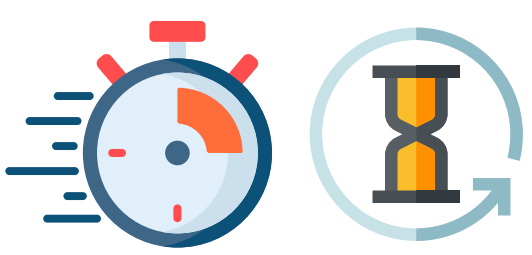
Correct



Incorrect

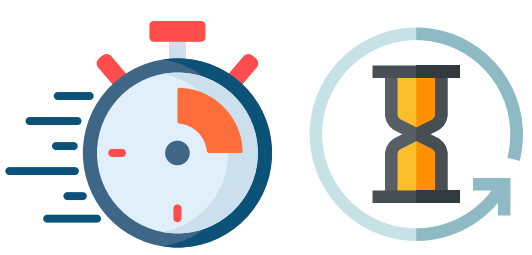


More instructive but
potentially “scary” or unsettling



Roadmap

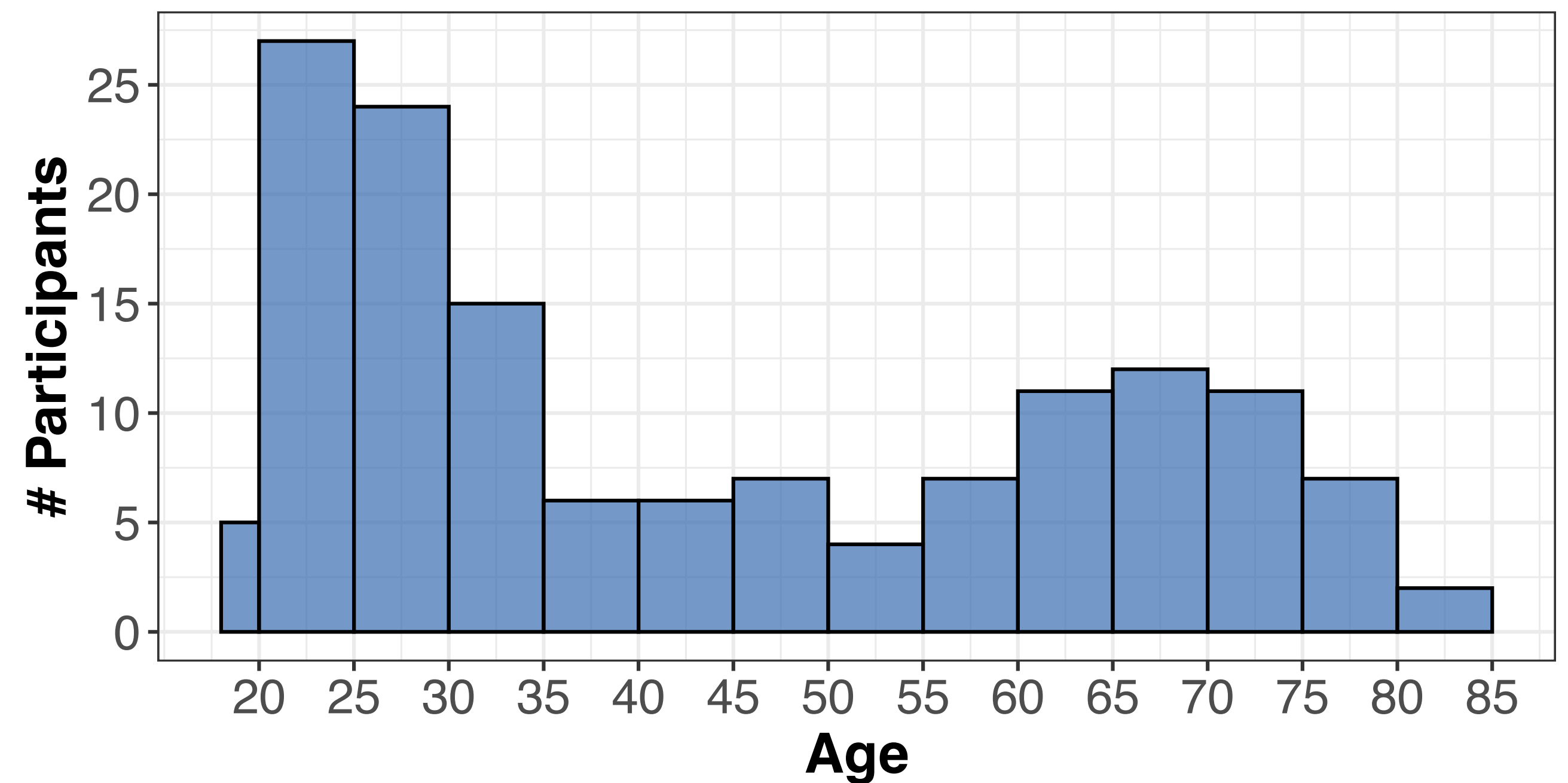
- The Coercion-Resistance Challenge
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150 Participants

Control Group: 30

Each Treatment Group: 30



Average: 44

Median: 36.5



Reported Coercion Incidents

Reported Sources

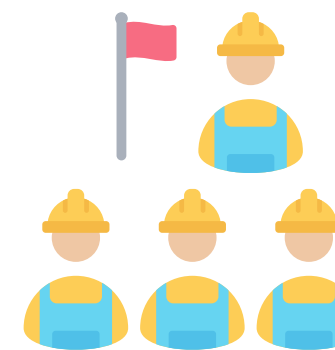


26%

report experiencing or knowing of someone who has experienced at least one form of voter coercion.



Spouse



Unions



Colleagues



Party Members

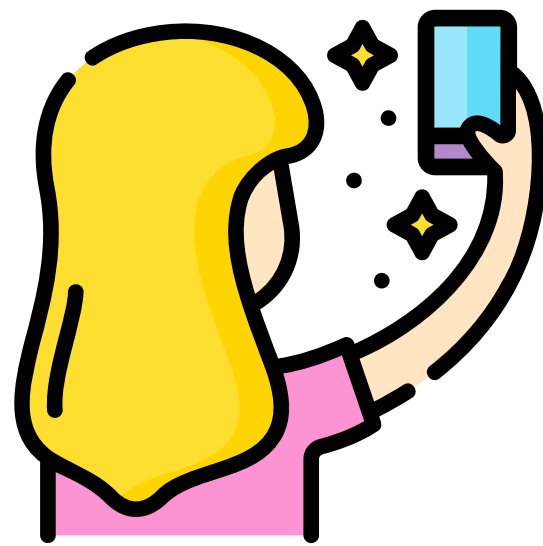


Coercion Scenarios

Scenarios in Study



Forceful



Ballot Selfie



Buying Ballots



Vote-Buying App

Most Likely



Ballot Selfies

Extremely likely: 24%

Reported: 23%*

Most Reported



Forceful

Reported: 46%*

Perceived as **least** Likely

* Among the 26% experiencing or knowing of someone who has experienced at least one form of voter coercion.



Coercion Sources

Sources in Study



Family Members



Authority



Employer



Party Members

Most Likely



Family

Extremely likely: 21%

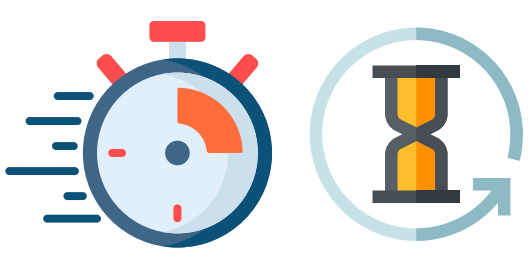
Most Reported



Family

Reported: 58%*

* Among the 26% experiencing or knowing of someone who has experienced at least one form of voter coercion.



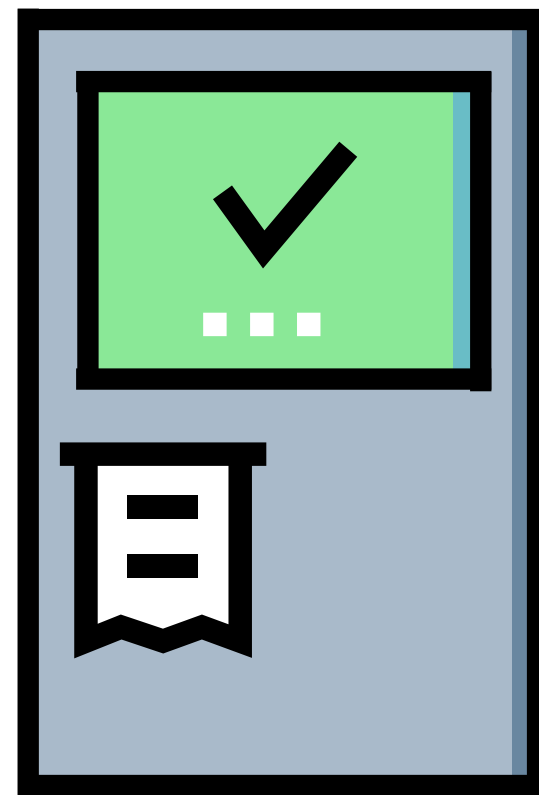
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Success Rate

Create Credentials



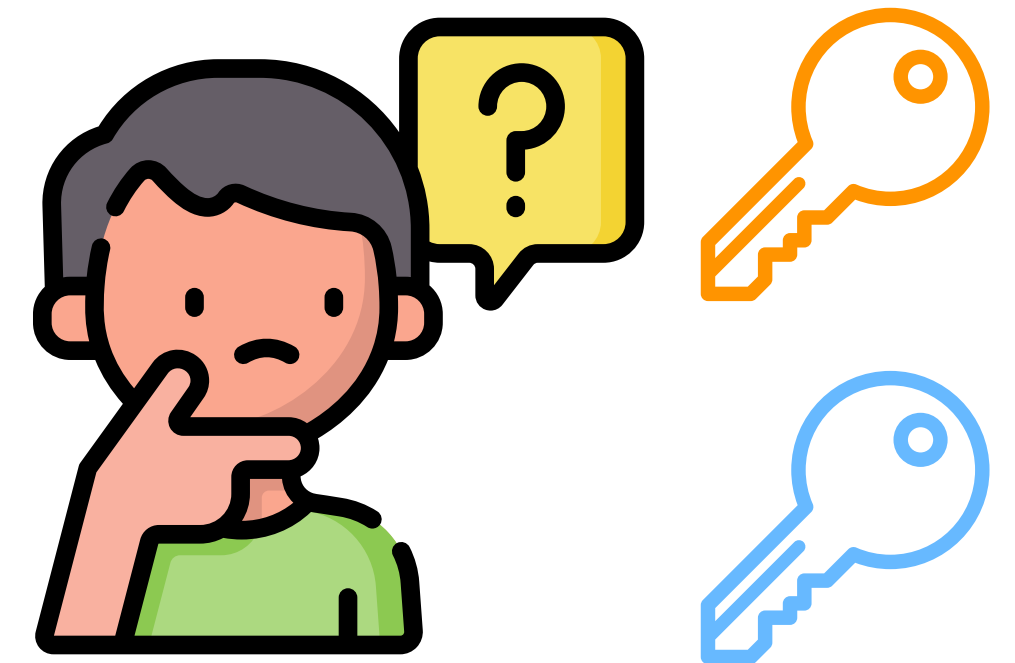
95%

Activate a Credential



92%

**Vote with
Real Credential**



90%

87%

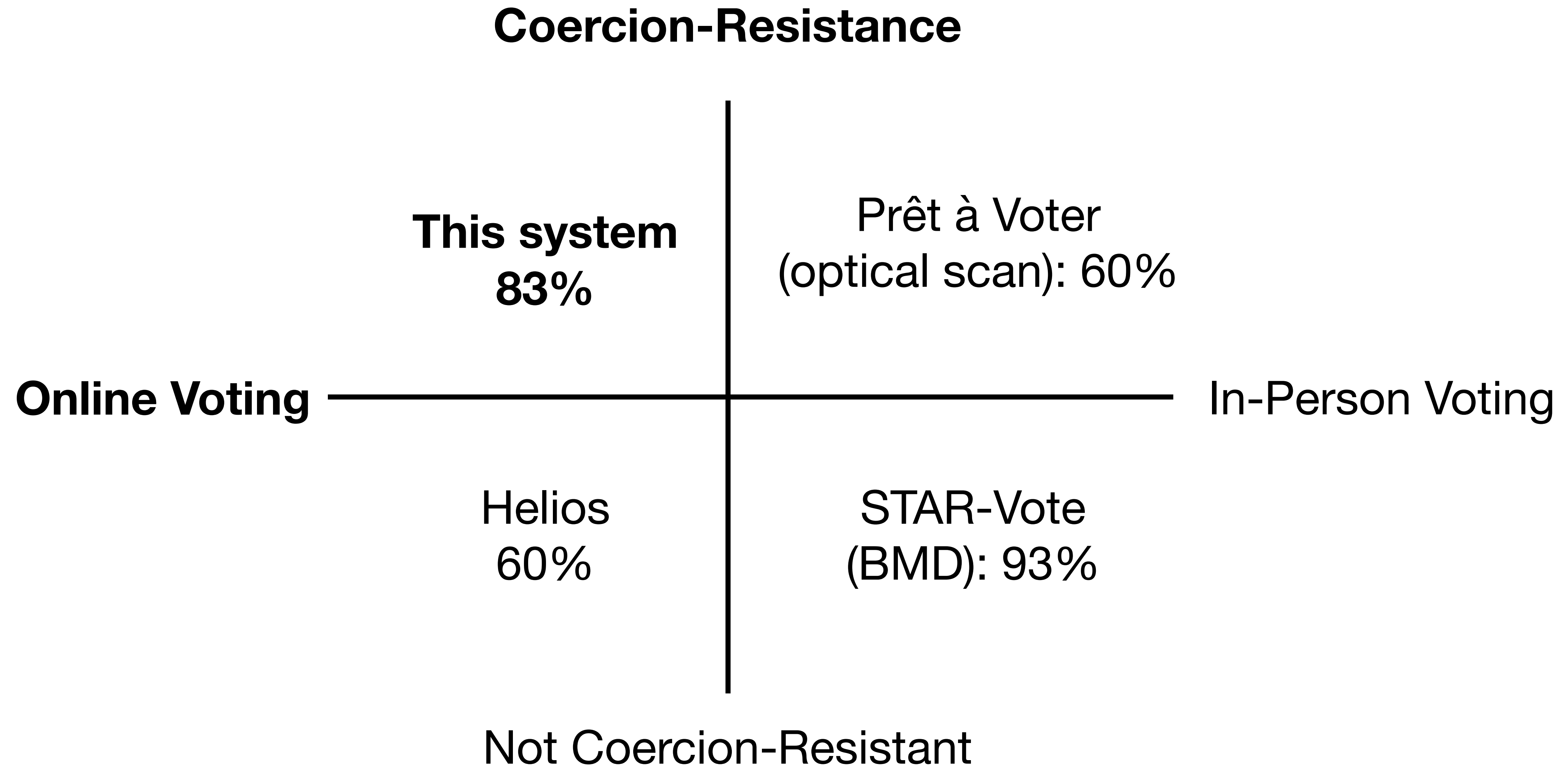
83%

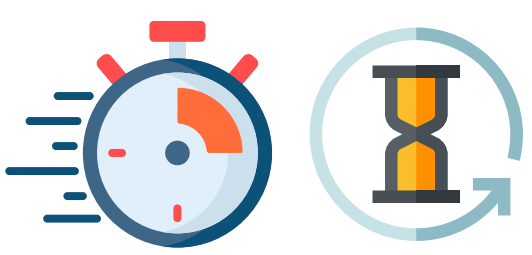
83%

83%



Other Verifiable Voting Systems

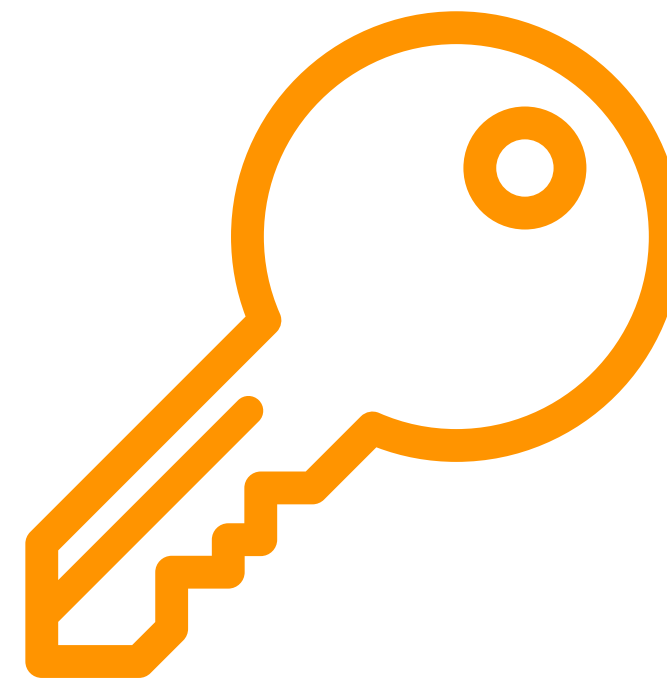




Fake Credentials



96% understood its use



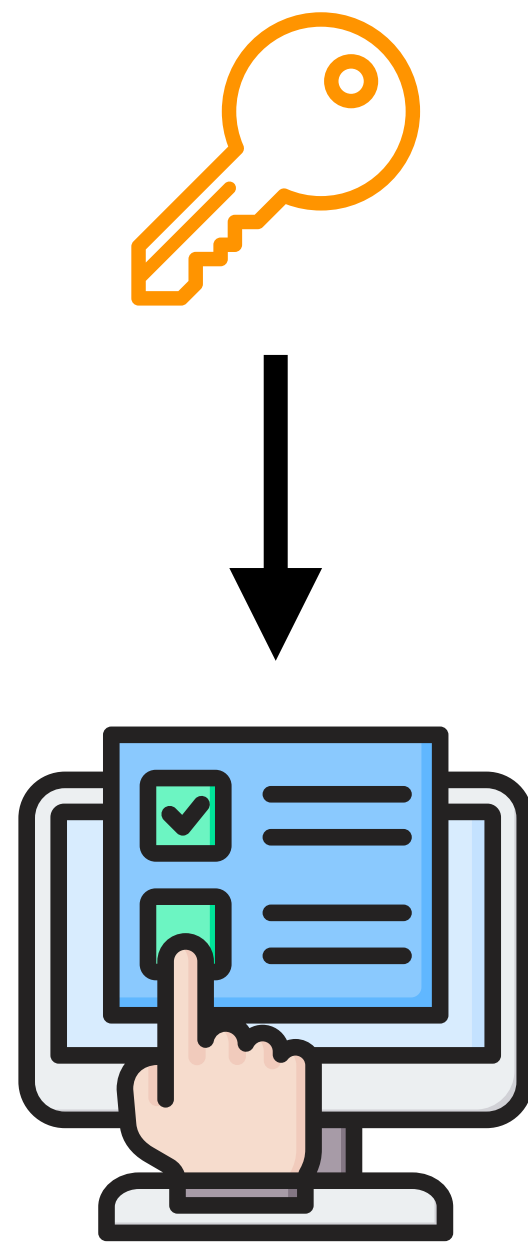
76% create at least
one fake credential



53% would create



Improper Use of Fake Credentials



10% cast their intended vote
using their fake credential



Memory Lapse?



Environmental
Distractions?



Misunderstanding
Instruction?

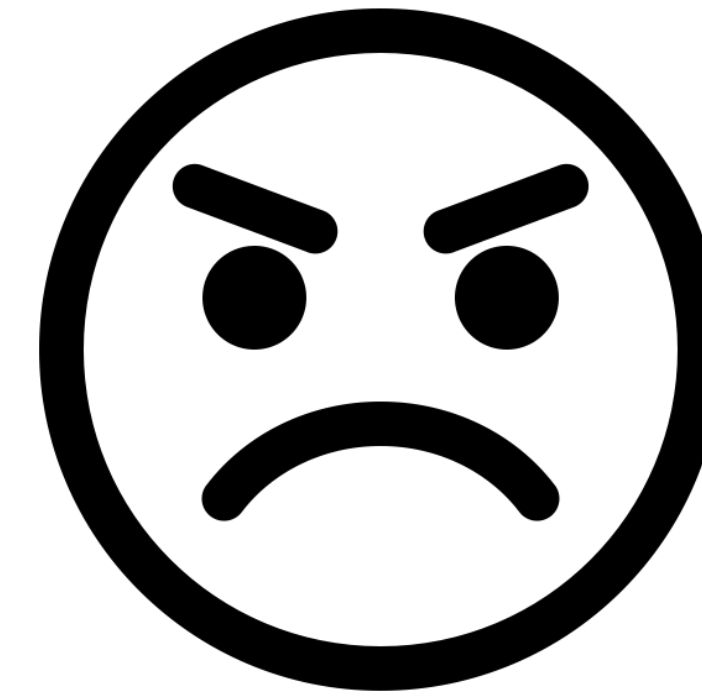


Deliberately
Disobeying?



Real World?

Fake
credentials!



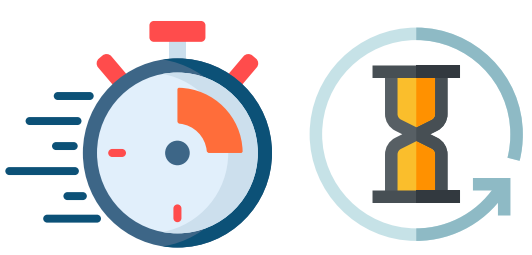
Only real
credential

"to argue less to
voting"

"[...] To [...] educate family and
vote friends"

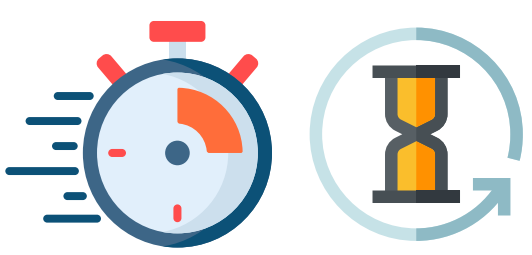
"create as many test credentials
[...] before the market became
flooded with test credentials"

"I cannot im
someone
[...] I want to take the risk of
on my real
"Not interested in the
uses"



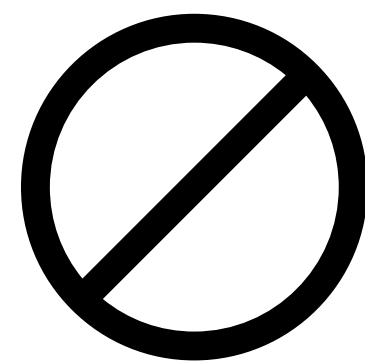
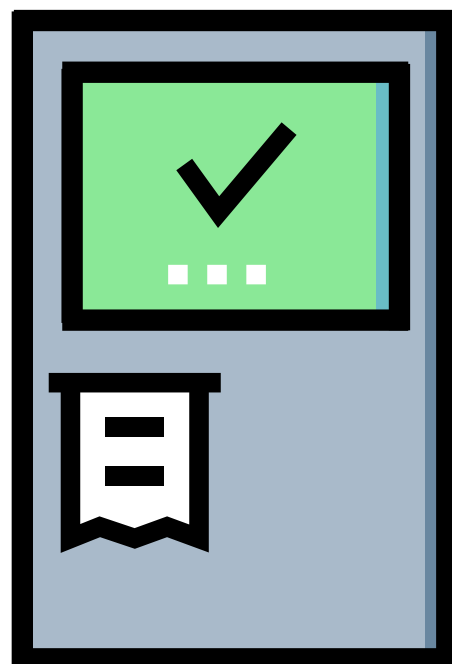
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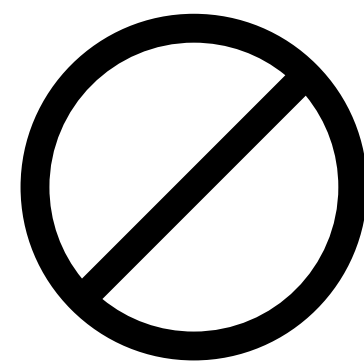
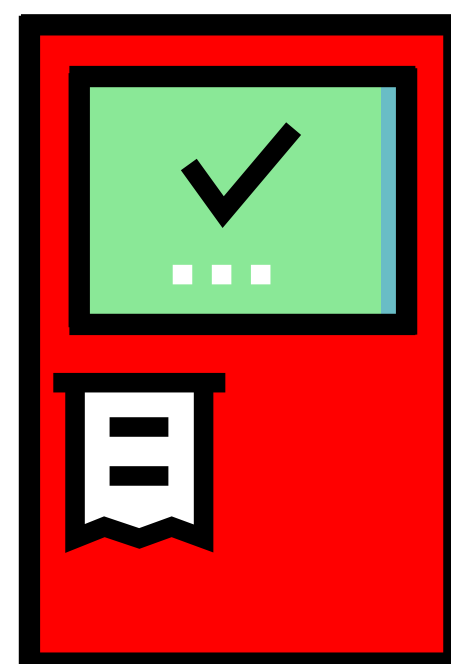


Kiosk Reported as Malicious

Without Security Priming

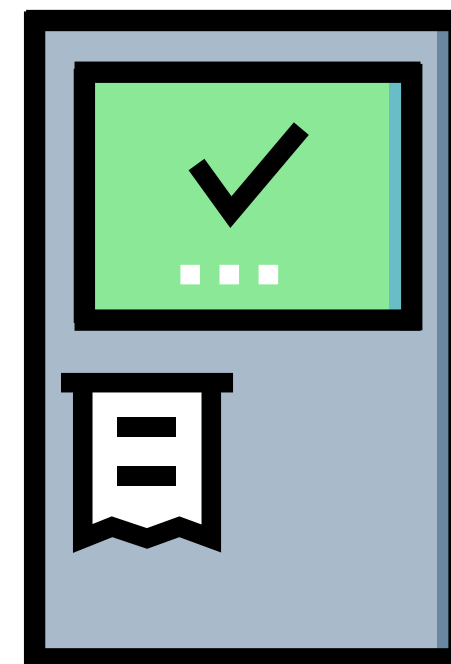


0%

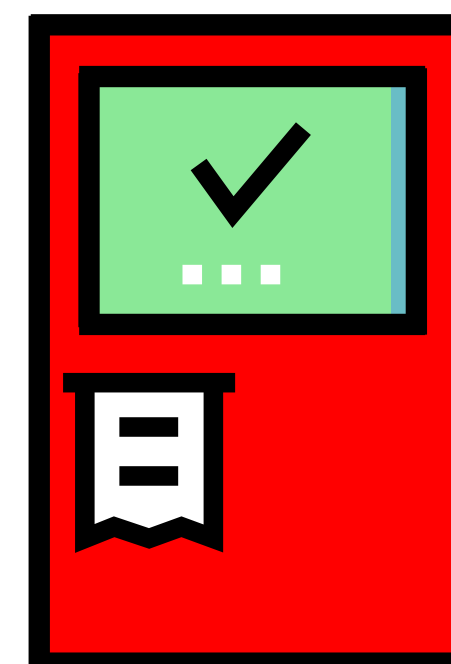


10%

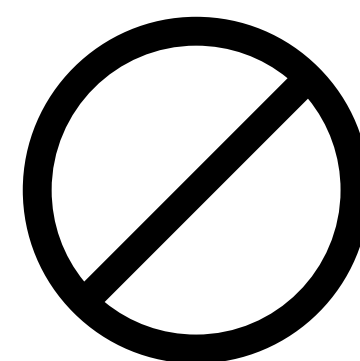
With Security Priming



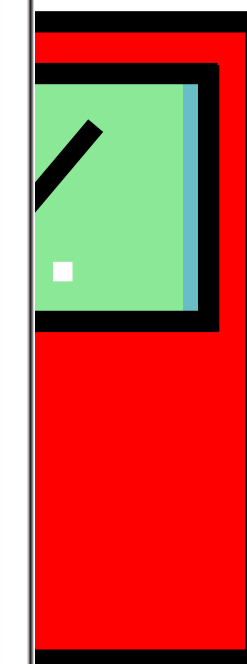
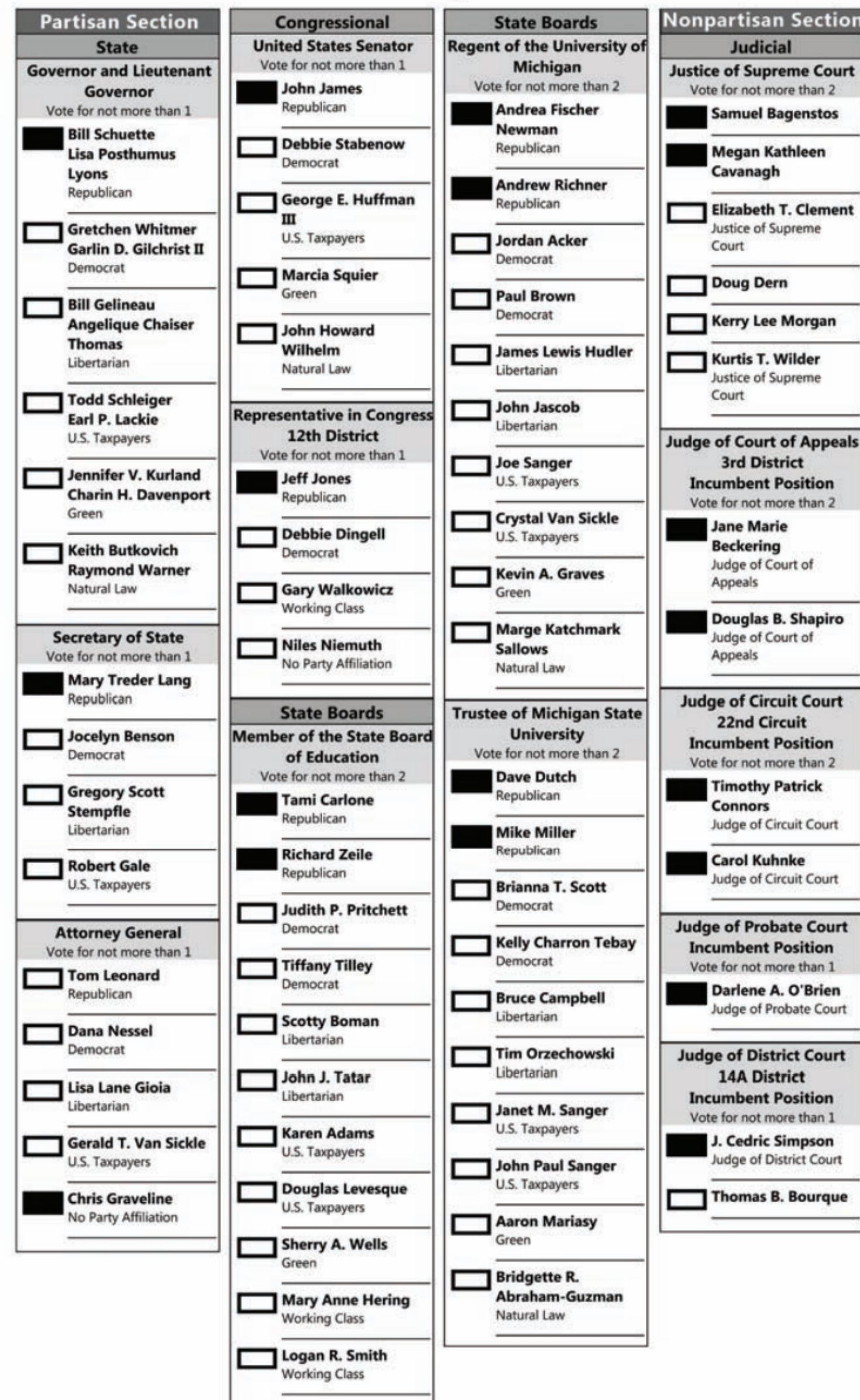
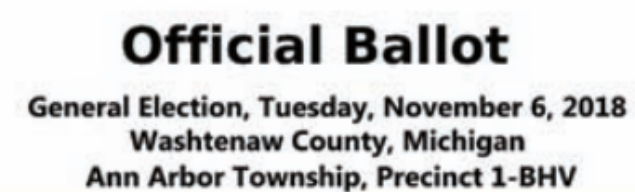
0%



47%



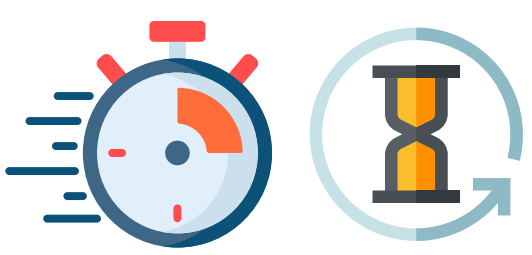
7%



8%

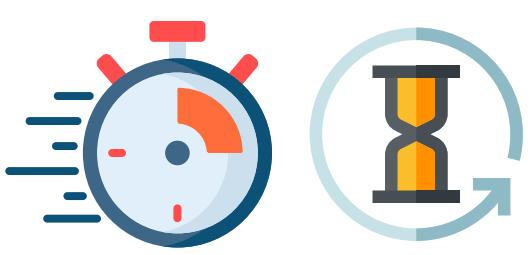
Bernhard, Matthew, et al. “Can Voters Detect N

Symposium on Security and Privacy, 2020

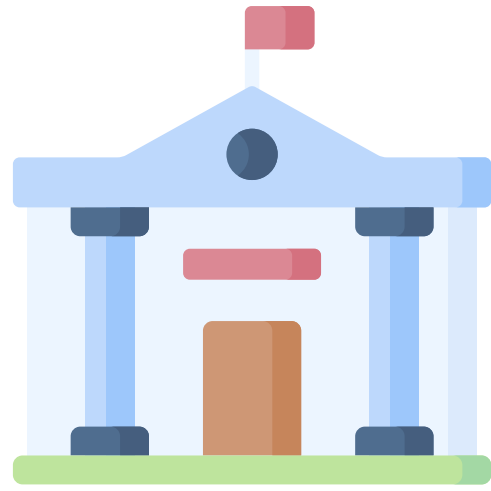


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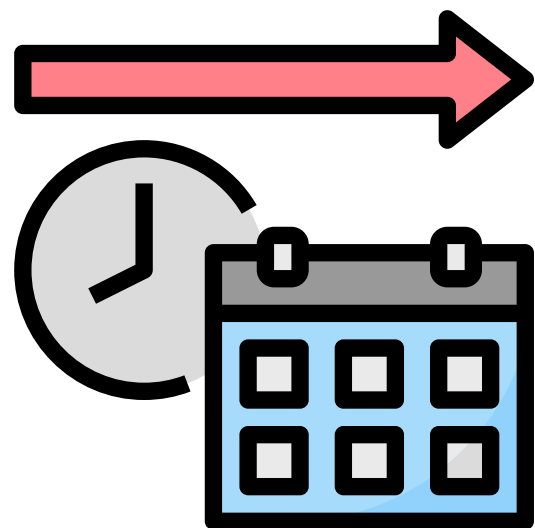
Study Limitations



Did not replicate an official registration environment



Did not study voters actually under coercion



Did not study long term storage, use of credentials



Conclusion

Fake Credentials

The Coercion Problem



26%

faced coercion or know
of someone who did

96%

Understood the use
of fake credentials

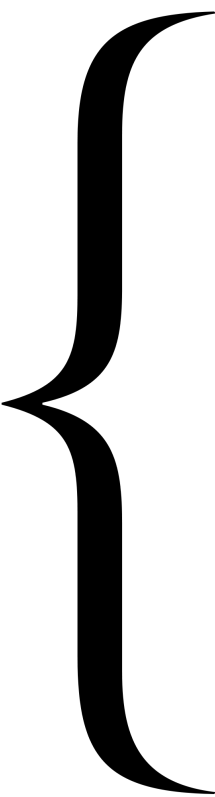
53%

Willing to create fake
credentials in reality

Usability of Fake Credentials

STAR-Vote: 93%

Online Voting



TRIP
83%

Helios: 60%

Prêt à Voter: 60%