IT UNIVERSITY OF CPH

Designing a User Interface for a Coercion-Resistant Online Voting System

A thesis submitted for the degree of

BSc Data Science

https://github.com/jakubmraz/Bachelor-Thesis-Project

Jakub Mráz

Student 21387

jamr@itu.dk

Supervisor:
Oksana Kulyk

Co-supervisors:
Christina Frederikke Nissen
Rosario Giustolisi

IT University of Copenhagen

May 2025

Contents

Abstract

Online voting offers convenience but introduces risks like voter coercion, where individuals are forced to vote against their will. While coercion-resistant voting systems exist, their complex security features often compromise usability. This thesis addresses the challenge by designing and evaluating a user interface (UI) for Loki, a novel coercion-resistant online voting system featuring deniable revoting and intentional vote invalidation. The research question guiding this work is: **How can a user interface be designed and implemented to maximize the usability of a complex, coercion-resistant voting system for all voters?**

Employing an iterative, user-centered design approach, a prototype UI was developed using Next.js, focusing on design goals such as maintaining plausible deniability, minimizing stress-induced errors, using progressive disclosure for help, providing clear explanations, incorporating memory aids (identicons and passphrases), and normalizing security features. A qualitative usability study (N=11) involving IT professionals and computer science students evaluated the UI through task-based scenarios (initial voting, revoting, voting under simulated coercion) using a think-aloud protocol.

Findings indicate that while the basic voting process was intuitive, the coercion-resistance features introduced significant usability challenges. Participants struggled with the memory burden required to identify previous ballots for revoting, leading to errors. While the concepts of revoting and vote invalidation were generally understood, using them effectively, especially under simulated coercion, proved difficult without clearer guidance and better user education. The study highlighted a tension between security (plausible deniability) and usability (user expectations for system feedback and memory).

The project concludes that designing a usable interface for complex coercion-resistant systems like Loki is feasible but requires careful balancing. Key areas for improvement include enhancing memory aids, providing more effective user education prior to and during voting, and refining feedback mechanisms to build user confidence without compromising security. This work contributes a tested UI design for the Loki system and offers insights into the human factors critical for the adoption of secure online voting technologies.

Introduction

A natural continuation of government digitalisation is enabling citizens to vote in elections online. Countries like Switzerland and Estonia, at the forefront of modernising bureaucracy, experimented with digital voting. Estonia declared the development a large success and in 2023, more than half of the votes were cast over the internet for the first time since the introduction in 2005.

Despite the convenience, internet voting is not without its issues. One such issue is the potential of voter coercion. Unlike physical voting booths in healthy democratic systems, online voting solutions have no way to guarantee the user's right to the secret ballot. A coercer can thus be physically present and watch while the user casts their vote, forcing them to cast a vote against their true intentions. This risk, if not adequately addressed, can undermine the fundamental principles of free and fair elections, and can become an obstacle to the widespread adoption of digital voting systems.

Several research papers were published detailing novel internet voting systems that employed strategies to prevent voter coercion. One such strategy was called Deniable Revoting, which allowed voters to change their vote at any point before the election closes, potentially letting a coerced individual correct their vote after being forced to vote under coercion. The Estonian internet voting system currently allows this. While helpful in increasing the system's coercion resistance, Deniable Revoting has a key weakness – the coercion can occur at the last minute of the election period, making it impossible for the user to change their vote at a later point. The research paper Thwarting Last-Minute Voter Coercion by Giustolisi et al [1] from the IT University of Copenhagen details a novel internet voting system named Loki, which focuses on preventing this scenario alongside the more usual coercion strategies.

As most security features usually come with a usability trade-off, the goal of this project is to design a user interface for Loki with a focus on maximising usability without sacrificing security. The second goal is to evaluate how users would react to Loki when presented with this user interface. The research question is thus: **How can a user interface be designed and implemented to maximise the usability of a complex, coercion-resistant voting system for all voters?**

This project's novel contribution is developing and testing a user interface specifically for Loki, to see how users react to its security features.

Background

Voter Coercion

Coercion is a situation where an individual is pressured to cast a vote that does not reflect their true intentions. This can be due to external pressures, threats, offering of rewards, or manipulative tactics [2]. In free elections, coercion is mitigated by each citizen's right to a secret ballot, which stipulates that no one may be present to see one filling out their ballot. This right is protected by the official polling stations, where government workers and security personnel enforce it [3].

Internet voting fundamentally alters this environment. It removes the spatial and procedural safeguards of physical polling places, allowing ballots to be cast in uncontrolled settings. As a result, there is no effective mechanism to guarantee the voter's privacy or prevent external influence during the act of voting [1].

Coercion in digital elections can take several forms. A coercer may instruct the voter to select a specific candidate, abstain from voting, or even surrender control of their voting credentials. Vote buying also becomes more viable, as coercers may demand proof of compliance—such as screenshots, voting receipts, or direct access to the system [1].

Coercion Resistance

Coercion resistance is the capacity of a voting system to prevent adversaries from forcing voters to cast a particular vote or from verifying whether a voter complied with such demands. It is a critical security requirement for internet voting systems, intended to preserve the secrecy and integrity of the vote even in the presence of coercion attempts [1].

Academic literature defines coercion resistance through formal security models. Many of these rely on game-theoretic frameworks, analysing whether a coercer can infer a voter's true choice with better than random accuracy. Others use the concept of observational equivalence, where a system is considered coercion-resistant if a coercer cannot distinguish between a coerced vote and one cast freely [1].

Coercion-resistant Systems Proposed in Background Literature

The following section presents several proposed coercion-resistant voting systems and their key design strategies. Each system underwent usability testing or theoretical evaluation, revealing specific weaknesses. These recurring usability issues are explained in the subsequent section.

Besides usability and coercion, another crucial issue with internet voting systems is that they must also remain secure from insider tampering – they must not rely on a single authority to trust with all security properties. These issues are out of the scope of this project [1].

Fake Credentials

This method involves providing users with the ability to create one or more fake login credentials, indistinguishable from the real ones. When a voter is under coercion, they can login using one of the fake credentials or present them to the coercer, casting a vote that will then be silently nullified during the tallying process. A key security advantage is that the user can effectively deceive coercers, provided that the fake credentials are cryptographically indistinguishable from the real ones [4][5].

Deniable Revoting

This method allows the user to cast multiple ballots, with only the last submitted ballot being counted. A voter who is being coerced can initially cast their vote as instructed by the coercer. The voter can then login again to cast their actual vote, once they can do so privately. This new vote will overwrite the previous coerced one. Like fake credentials, this allows the user to seemingly comply with the coercer, while removing the hurdle of managing multiple credentials [6].

The country of Estonia, currently the only one with full-scale nationwide internet voting, offers this option.

Decoy Tokens

This method provides the user with a set of "voting tokens", out of which only a smaller subset is valid, while the rest are decoy. When voting, the user selects options on their ballot by assigning them the valid tokens, while assigning the decoy tokens to the rest. Since the coercer does not know which tokens are valid and which are decoys, a voter under coercion can theoretically assign a decoy token to the candidate they are instructed to vote for and the valid token to the intended candidate. This results in the user being able to cast their intended vote even if the coercer is physically watching them during the whole process [7].

Loki - Flexible Vote Updating

The system this project focuses on – Loki, as described by Giustolisi et al [1], combines the promises of all three methods mentioned above, enabling users to both deniably revote and cast deniable ballots under coercion, similar to the fake credentials and decoy tokens systems.

Loki maintains a Cast Ballot Record (CBR) for each voter on an append-only bulletin board. This bulletin board is public to ensure transparency and verifiability. The CBR contains all ballots associated with the voter, including those cast by the voter and "noise" ballots generated by the Voting Server. The Voting Server periodically adds new noise ballots to the user's CBR, which are computationally indistinguishable from real ballots. These serve to obfuscate the user's voting pattern and to make it impossible to determine the user's real ballots from the public bulletin board.

The voter maintains (ideally in memory) a secret list containing the indexes of the actual ballots they cast within their own CBR. When a voter casts a ballot, they encrypt both their vote and the list of indexes, sending both to the Voting Server. If the list of indexes is correct, the Voting Server accepts the ballot and obfuscates it with noise ballots. If the list is incorrect, the system assumes coercion and, following the obfuscation as with a regular vote, encrypts the CBR in a way that invalidates the newly cast vote. Neither the user nor a coercer can detect that the vote was invalidated, and it cannot be inferred from the CBR.

When voting under supervision, the coercer cannot determine if the submitted list of indexes is correct or not and thus cannot know if the coerced vote will be counted or not. This effectively equips the user with two ways to resist coercion – deniable revoting and deniable intentional vote invalidation.

This mechanism depends on the voter having at least one opportunity to cast a valid ballot. Loki therefore has no way to protect against a coercion scenario where the coercer instructs the voter to abstain from voting altogether.

Usability Issues Identified in Background Literature

Comprehension of New Concepts

Voters often struggle to understand novel anti-coercion mechanisms without clear guidance. In a usability test of a coercion-resistant voting app ("Vote App"), many participants failed to grasp core features when instructions were minimal. For example, users did not realize that the system assigns a unique voting PIN that remains constant, nor that they were allowed to re-vote multiple times – concepts very different from typical apps. Several participants also misunderstood the purpose of the fake credential (ruse PIN) meant to thwart coercers, with some questioning why they needed a special "decoy" PIN at all when they could "simply enter a random one" [4].

Another user study of a fake-credential scheme showed 10% of participants mistakenly used the wrong credential to vote, effectively invalidating their ballot. This error occurred even though 96% of participants understood the concept of fake credentials in theory [5].

These gaps in understanding highlight a consistent challenge in prior systems: critical coercion-countering features are often misunderstood or overlooked by users due to unclear interface communication.

Memory Burden and Secrecy

Many coercion-resistance strategies rely on the voter memorizing a secret or performing an extra step. This raises a usability vs. security tension: the voter must remember secrets (like an alternate password, PIN, or code) and recall them under stress, but humans have limited memory reliability [8]. Preliminary findings from a study (N=26) on voter coercion found memorability to be a pivotal factor – most counterstrategies require the voter to remember a secret, and users perceived this as a usability hurdle [9]. If a voting system requires voters to retain a PIN or credential without writing it down (to avoid coercers finding it), memory lapses could lead to mistakes.

Information Overload vs. Lack of Guidance

Striking the right amount of instructional information is difficult. Voters need to be informed about unusual steps (like "enter a backup code" or "choose a control number") but excessive text can overwhelm or annoy them. The Vote App study found that some participants felt the on-screen explanations were too long or detailed, while others felt those explanations were essential for such a security-critical application. Too little information led to user confusion in that study – for example, encountering a screen with "control numbers" to select left many users asking "What am I supposed to do now?". At the same time, lengthy warnings or technical jargon can reduce usability. Finding this balance is an acknowledged challenge [4].

User Perception of Need and Trust

Another challenge is that not all voters perceive coercion as a real threat, which affects their willingness to tolerate extra security steps. Interviews reveal that if voters think voter coercion "could never happen here," they may see anti-coercion features as unnecessary complications [9]. On the other hand, participants with personal or direct experience of coercion were more willing to use safeguards and even rated a coercion-resistant system as equally trustworthy as traditional voting [5]. Prior research noted that introducing entirely new voting concepts requires careful user education and even public awareness campaigns, but without undermining confidence (for example, scaring users about threats to the point they lose trust in the system) [5][10].

Stress and Performance

Coercion scenarios are high-stress situations for users. A voter under pressure (real or perceived) is more prone to errors. Usability testing in controlled settings can only partially simulate this dynamic. Researchers caution that it's hard to truly assess how users will behave "in a situation which involves fear" [4]. Prior work has also shown that limited system feedback, often intended to preserve ballot secrecy, increases the cognitive burden on voters who must complete sensitive actions without confirmation [10].

Developing the UI

Design Goals

Maintain plausible deniability at all points

Plausible deniability refers to "circumstances where a denial of responsibility or knowledge of wrongdoing cannot be proved as true or untrue due to a lack of evidence proving the allegation" [11]. Since the coercer and the user will see the same user interface, both must be considered as the same person from the view of UI design. Any information revealed to the user is also revealed to a potential coercer. This means that the interface must not disclose any information about the user's voting history to the user. This gives the user the power of plausible deniability for all actions they take under supervision. In other words, they can intentionally cast an invalid ballot under supervision while plausibly claiming its validity.
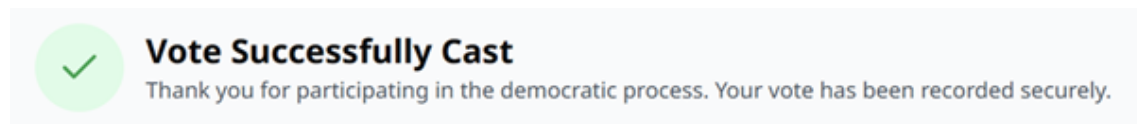

Figure 4.1: The UI displays a "vote successfully cast" message regardless of the ballot's actual validity – giving the user plausible deniability when intentionally casting an invalid ballot, while also sacrificing usability by not informing the user of mistakes.

This presents a significant usability trade-off, as users instinctively expect the website to know these things about them and when it looks like it doesn't, they perceive it as a malfunction (see section Usability Study, Results). The UI must therefore take great care to explain to the user that every instance where they might expect the site to already know things it is asking them about, that this is intentional and for a reason.

> 🛡 **Anti-Coercion Feature — every user sees this regardless of whether they've voted before or not**
> This security measure ensures that only you can modify your vote.
> Your vote will only count if you correctly identify your voting history.

Figure 4.2: Following confusion during the usability test about the website "not knowing" users' voting history, I took extra care to explain the concept of plausible deniability. The wording "every user sees this" instead of "you are seeing this" was a deliberate choice to minimise the risk of the coercer associating any anti-coercion features with the victim's account.

The design must be robust against stress-induced errors. In a coercive moment, a voter may not have time to read help pages or recover from mistakes. Any confusing or fragile step could result in either compliance with the coercer or an accidental vote invalidation. In the fake-credential study, 10% of users accidentally used their decoy credential to vote [5]. In Loki's case, the user can avoid dealing with the security features when casting their first vote, but not when revoting. The UI should therefore provide enough information during the revoting process to minimise the risk of accidentally invalidating a vote meant to be valid. It should also inform the user about the possibility to vote physically in a situation where the user can't recall their secrets.

During internal testing, a common pattern was that users felt everything was obvious and didn't read the initially less visible security notices. This resulted in them sometimes unintentionally casting an invalid ballot. A popup card, prompting the user to double check their selections helped alleviate this issue.
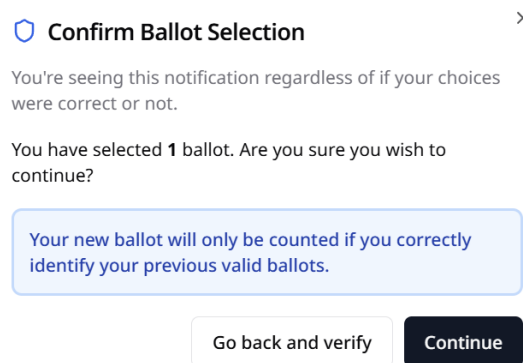

Figure 4.3: Upon submitting their selection of past ballots, the users are prompted with a warning text to ensure they're aware of the possibility of casting an invalid ballot.

Use Progressive Disclosure for Help

A practical way to balance information is to layer it. Loki's UI should provide on-demand help (tooltips, "Learn more" pop-ups) rather than wall-of-text descriptions on every screen. Vote App's [4] interface added a "magnifying lens" icon on almost every screen which users could tap to get more detailed info about that step. The UI could similarly include context-sensitive help – for instance, a help icon next to

the re-vote button explaining when and why to use it. This way, novice or uncertain users can easily access guidance, while experienced users aren't slowed down. An integrated user manual or FAQ accessible from the interface is also recommended [4]. By designing help as an optional layer, one can ensure voters have the information they need without overwhelming everyone by default.

Figure 4.4: The help button is always present at the top right of the screen. This allows the user to open the whole Help Centre at any point.
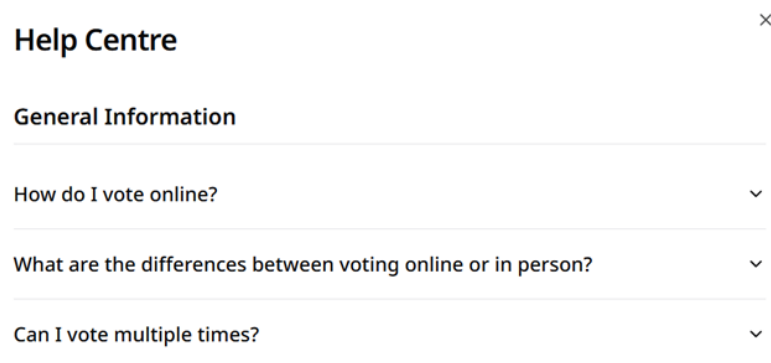

Figure 4.5: The Help Centre contains the entire user manual. Each expandable part is framed as a question the user may ask and, once clicked, shows the explanation as answer to the question.
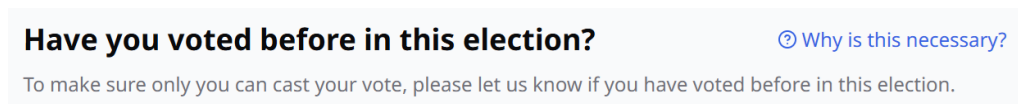

Figure 4.6: Each novel feature also has a "learn more" style button, which acts as a shortcut to the relevant section of the Help Centre.

Explain Security Features in Plain Language Without Sacrificing UX

The UI must provide clear, succinct explanations for any non-standard voting step. Users should never be left guessing "why am I being asked to do this?" In Loki's case, the user must identify their last previously cast valid ballots to change their vote. The Vote App evaluation showed that lack of upfront explanation led to confusion about core functions. At the same time, it should avoid alarming or technical language – instructions should be neutral and reassuring. Designers found it helpful to remove exclamation marks or words like "ATTENTION!" which can unnecessarily panic users. The UI must strive for a calm, guided experience where security steps feel like a normal part of the flow. Building trust is key – if the UI appears too complicated or "paranoid," some users might abandon it or distrust the system.

The research suggests that users do appreciate security when it's made usable. In the Vote App study, participants reported high satisfaction and specifically appreciated the system's security features and overall ease of use [4]. This indicates that a well-designed UI can turn security measures into a net positive part of the user experience (users feel safer and in control, rather than burdened).

However, a caution is warranted: another study found that when users were given a stronger security briefing (making them more vigilant for threats), their subjective usability ratings went down slightly. Essentially, reminding users of security risks can cause anxiety, affecting their comfort. The trade-off was that those users were far better at detecting a simulated attack (catching a fake voting terminal) [5]. The lesson for Loki is to find a balance in messaging – educate users about security in a gentle, non-alarming way, perhaps by including a short optional tutorial or use tooltips that mention security tips, rather than a scary warning banner. By carefully tuning the tone and amount of security messaging, Loki's UI can keep users alert without overwhelming them. As one recommendation puts it, incorporate user education and awareness early, but ensure the additional information "will not overwhelm the voter or make them distrust the system" [10]. Achieving this balance is tricky but vital for a positive user experience.
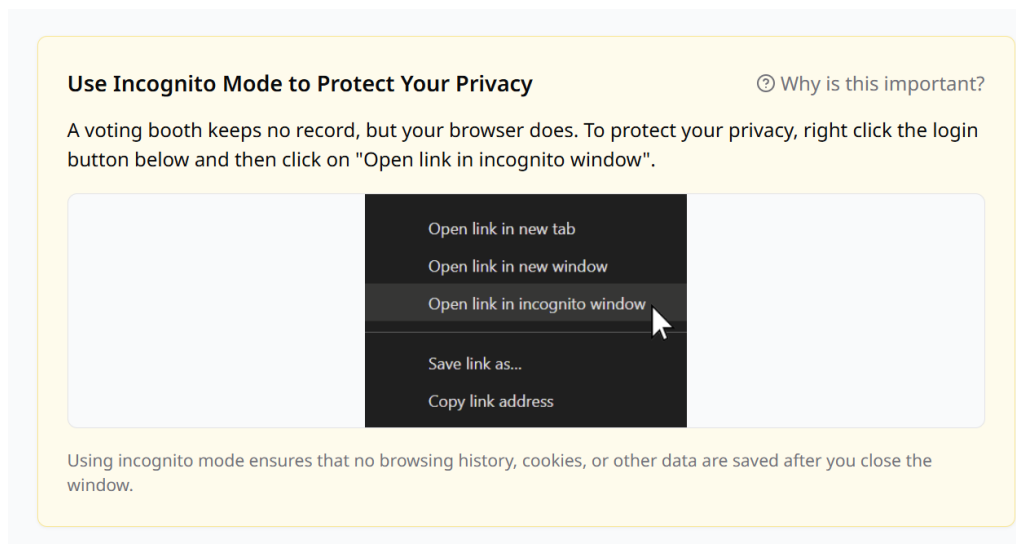

Figure 4.7: The UI explains concepts and security features in a non-alarming way that frames them as empowering the user, rather than stoking fear.

Provide Memory Aids

Given the importance of memorability, the UI should incorporate features that help users manage the required secrets or codes. One approach is using recognition over recall – for example, representing confirmation codes or PINs with easily recognizable images or emoji sequences in addition to text. Vote App displayed a string of "Private PIN Emojis" alongside the user's PIN as a visual cue, which some users found helpful (familiar from apps like Telegram) [4]. Other research similarly found that user-generated visual markings can significantly improve retention of secrets without external notes [5]. Another aid is letting users double-check or confirm entries: for instance, a participant suggested allowing voters to enter their PIN twice

to be sure they didn't mistype it, since the second entry would catch if they mis-remembered it and saw the wrong emoji feedback [4]. However, any such aid must be covert if an adversary is present. Designers should avoid solutions that rely on visible notes or additional devices during the voting session, because a shoulder-surfing coercer could see those. Instead, the secret itself should be easier to remember (e.g. a passphrase of four common words) and users should be guidance on memorization techniques upfront [10].

In Loki's case, users must remember the date and time they cast their ballot to be able to recast a new one later. The purpose of visual memory aids is thus to provide the user with something they might find easier to remember than a timestamp.
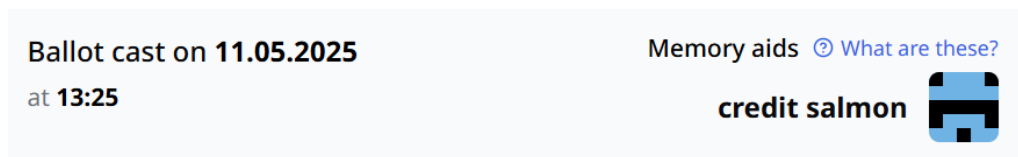

Figure 4.8: The UI provides two memory aids – a two-word phrase and an "identi-con", both generated from the ballot's hash.

Normalize Coercion-Resistance Features for All Users

A crucial lesson is to design the UI so that using anti-coercion features doesn't itself look unusual. Everyone using Loki should follow roughly the same visible process, whether or not they are under duress, so that a coercer observing cannot distinguish a voter who is invoking a special countermeasure. For example, if the system supports re-voting, the interface should encourage all voters to review and even recast their vote if they change their mind – not frame it as a niche "coercion recovery" feature. Estonia's i-voting system did this by allowing any voter to vote multiple times (only the last vote counts), making re-voting a normal behaviour [10]. Loki can adopt a similar approach: advertise revoting as a convenience ("You can adjust your vote until the deadline") so that a coerced voter's extra vote doesn't raise flags. The key is that nothing in the interface blatantly says "coercion mode" or otherwise tips off an observer. Blending these security features into the routine flow is one of the strongest lessons from the literature on coercion-resistant voting schemes [10].
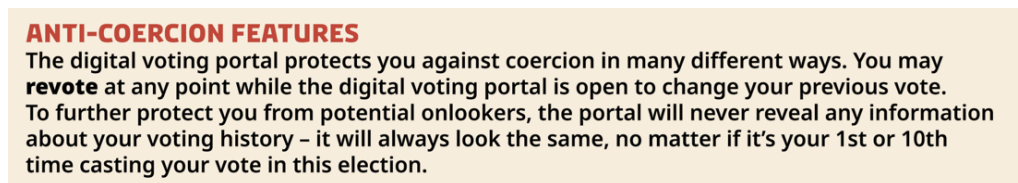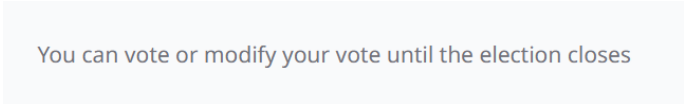

Figure 4.9: An exempt from the information flyer that would be distributed to all eligible voters before the election in order to inform about and normalise anti-coercion features.

You can vote or modify your vote until the election closes

Figure 4.10: The UI frames revoting as "modifying one's vote", akin to how one would change a setting.

Methodology

Technology Stack

The user interface was developed using Next.js and TypeScript. Next.js is a web development framework built on top of React. It provides additional functionality, such as support for multiple rendering strategies per page (static generation, server-side rendering, and client-side rendering) [12].

A key library used was shadcn/ui, which provides locally stored, prebuilt UI components such as buttons, breadcrumb navigations, and accordions. Unlike traditional UI libraries that fetch components from external sources, shadcn/ui stores them within the codebase, enabling full customization and eliminating runtime dependencies [13].

Design and Implementation of Memory Aids

The purpose of the memory aids was to provide the user with additional memorable information to complement the timestamp, making each ballot more distinct and easier to remember. This could however not compromise the system's security by storing any new information about the users or the ballots. The main goal was thus to generate the memory aids dynamically from the ballot information provided by the Voting Server. The algorithm needed to ensure that these generated memory aids be deterministic – the same ballot must always generate the same memory aids, and that they are unique for each ballot.

The natural choice was to use a deterministic hashing function. The implementation derives a SHA-256 hash from a ballot object's timestamp and ID, producing consistent results for the same input. It then uses this hash to generate both an identicon and a two-word passphrase.

To create the identicon, the algorithm selects a foreground colour from a predefined, colourblind-friendly palette based on the hash's leading bytes. It builds a symmetrical grid of boolean values by evaluating the parity of hexadecimal digits in the hash. To enhance visual recognizability, it mirrors each row vertically. Finally, it selects a high-contrast background colour, either black or white, based on the foreground's relative luminance to ensure readability and accessibility.

To create the two-word passphrase, the algorithm parses two four-character segments from the beginning of the hash and converts them into numeric indices. It then maps each index to a word from a predefined word list (the Bitcoin 2048 passphrase word list [14]), using modulo to stay within bounds. Finally, it combines the selected words into a space-separated phrase. By basing the selection on the hash, the function ensures that the phrase is deterministic and repeatable for the same input.

14

Ideally, the user would keep their ballot details in memory, as writing them down anywhere creates a risk of discovery by the coercer. This means that the fewer words to remember, the better. The UI however could not use only one passphrase per ballot, since with a 2048 word long word list gives a 100% chance of duplicates for 1000 ballots.

% Collision Probability (Birthday Problem Approximation)

$$P \approx 1 - e^{-\frac{k^2}{2n}}$$

where $k = 1000$ ballots and $n = 2048$ words

$$P \approx 1 - e^{-\frac{1000^2}{2 \cdot 2048}} \approx 1$$

Not only that, we can estimate using the balls and pins formula that for $k = 1000$ ballots and $n = 2048$ words, there will be $E \approx 791$ unique words. This subtracted from the 1000 ballots means approximately 209 duplicates.

% Expected Number of Unique Values (Balls and Bins Model)

$$E = n \left(1 - \left(1 - \frac{1}{n} \right)^k \right)$$

$$E = 2048 \left(1 - \left(1 - \frac{1}{2048} \right)^{1000} \right) \approx 791.33$$

By using two words, this increases the possible word combinations to $2048^2 = 4\,194\,304$, significantly decreases the chance of duplicates for a single user.

$$E = 2048^2 \left(1 - \left(1 - \frac{1}{2048^2} \right)^{1000} \right) \approx 999.88$$

The equations described above assume a uniform distribution and the results could therefore be wrong if the way the words affected by modulo bias, which occurs when a larger range of number is mapped onto a smaller one using the modulo operator, and the size of the larger range is not an even multiple of the size of the smaller range [15].

This does not apply for this case, as the range of two four-character segments from the hash make for $2^{16} = 65536$ possible values, which is perfectly divisible by the 2048 words the values are being mapped to.

$$65536 \div 2048 = 32$$

Iterative User-Centred Design

Kulyk and Neumann's review recommended involving users from the start in developing coercion-resistant systems and getting feedback on prototypes. Usability testing should be focused on Loki's unique features (e.g., have users attempt to vote with and without a coercion scenario) to catch issues early [10]

The project was developed by a single individual using an iterative approach. Each iteration spanned two weeks and concluded with a meeting involving the thesis supervisor and the two co-supervisors from ITU. These meetings served to collect feedback on the implemented features and to discuss potential changes. In addition, each iteration included informal testing sessions with other students to obtain early feedback on features under development.

For the internal testing sessions, I recruited other student workers from my workplace. Each internal test was conducted as at least two sessions with different students. The participants usually differed per iteration.

A total of four iterations were completed. The final iteration focused on refining and finalising the design in preparation for the usability study.

Development Iterations

First and Second Iterations

The first two iterations focused on implementing the core functionalities of the system. Thus, during the internal testing, I asked the others to help me find bugs and errors that would interfere with the flow of the program. I also asked what "quality of life" features they would appreciate.

This resulted in adding numerous "Back" buttons to allow users to redo certain steps and choices. I was also advised by my supervisors to add notifications about certain security features. A prominent example of this is the incognito mode suggestion shown in Figure 3.7.

Another group of additions was prominent red warnings and security notices that were meant to prevent users from accidentally casting invalid ballots. This went against practices suggested by the background literature and would later cause problems for some users during the usability study.
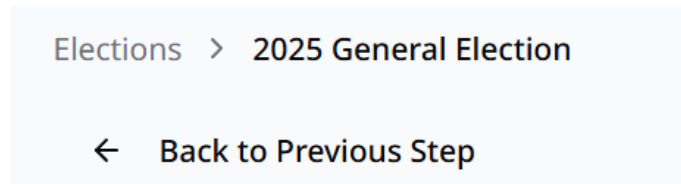

Figure 4.11: The back button, suggested during an internal testing session, allows users to easily redo a choice if they selected a different one by mistake or out of curiosity.

Figure 4.12: The voting entry page at the end of the second iteration.

Figure 4.13: The revoting page at the end of the second iteration, with a notable mistake that it shows the choices made on the ballot, which the Loki Voting Server would not provide in reality. This is good for usability but terrible for security.

Third Iteration

The system prototype was fully functional by the end of the third iteration. Thus, the internal testing served as a preliminary test run for the usability study to be done. Participants were asked an informal set of questions that could appear in the usability study. This allowed me to refine the questions asked by seeing which ones were more or less likely to yield useful information.

During the tests, I was able to refine design into a much better state, the best example being the revoting page, shown below.

Figure 4.14: The revoting page at the end of the third iteration, now with memory aids and showing 8 per page instead of an endlessly scrollable list.

Fourth Iteration

Following the usability study, I implemented changes based on issues the participants had directly with some UI elements. Changes that would require deeper changes to the system itself were left to future research.

The most notable issue was that the participants were much more likely to click the blue explanation buttons than the grey ones. The solution was thus to make them all blue. Another issue was, as mentioned in the background research, that some users found the red warning messages too alarming. I thus changed and reworded them to be empowering security reminders. Lastly, I updated various texts to be more informative.

Identify Your Previous Ballots ⦿ How do I identify my ballots? ⦿ Why is this necessary?

To protect your privacy, your previous ballots are mixed with decoy ballots. Please select ALL valid ballots that match your previous votes.

🛡 **Anti-Coercion Feature**
Your new vote will only be counted if you correctly identify all your previous valid ballots cast in this election.
This is to ensure no one can vote for you or coerce you into voting a certain way.
If you cannot remember your previous ballots, you can still revote once in person to override your digital vote.

All Ballots	Selected (0)

▽ Filter by Date   🕒 Filter by Time   🔍 Search phrases   ⦿ Why am I seeing so many ballots?

Showing 8 of 92 ballots   **0 ballots selected**

○ 04.05.2025 16:34 casino erode	○ 01.05.2025 16:51 lawsuit cheese
○ 01.05.2025 16:48 vague yard	○ 01.05.2025 16:37 gym salon
○ 01.05.2025 16:05 input round	○ 01.05.2025 15:38 place quick
○ 01.05.2025 15:01 deposit timber	○ 01.05.2025 14:46 track mushroom

‹ Previous   Page 1 of 12   Next ›

Figure 4.15: The revoting page at the end of the fourth iteration. Clickable help texts are now blue. The grey text clarifies that the user is seeing decoy ballots, not other peoples' ballots, which was a common misconception during the study. The red warning text was changed into an empowering message with blue colour and a shield icon instead of a warning triangle.

Usability Study

Methodology

I conducted a qualitative usability study of Loki's voting interface with 11 participants (3 IT professionals and 8 computer science/data science students from RUC, DTU, and ITU). These participants were personally recruited from my workplace and university. Each participant completed three usage scenarios: (1) Initial Voting – casting a ballot in a mock election; (2) Revoting – logging in later to change their vote after a hypothetical news event; and (3) Coercion – attempting to vote while under coercion. Participants were told the system had special anti-coercion features (notably, the ability to cast multiple votes with only the final one counting) and were given a brief narrative for each scenario (e.g. "imagine someone is watching you vote and forcing you to choose certain options").

During each session, I employed a think-aloud protocol: participants were instructed "to say out loud what [they're] looking at, what [they're] trying to do, and what [they] expect to happen" as they interacted with the prototype. I emphasized that "there are no right or wrong answers... you are not being tested; the system is". I refrained from assisting during tasks, instead encouraging users to rely on the system's on-screen instructions and help features: "once we begin, I will not answer your questions... use the tools and information the system provides... If you cannot find the answer, it is the fault of the system". This approach let me observe how well the interface supported independent use. All sessions were screen and audio recorded (with consent) for analysis, and I conducted semi-structured interviews post-task to probe users' impressions. In these interviews, I asked individuals how clear the process was, whether they felt the system explained key concepts (like revoting and invalid ballots), and how confident or secure they felt.

I transcribed each video using OpenAI's GPT 4o-transcribe API model [16] and then went through each file manually to annotate which sentences were spoken by me and which ones by the participants. This yielded 18 transcriptions overall (11 of Scenario 1 and 7 of Scenarios 2 and 3). I then qualitatively analysed the transcriptions to identify recurring usability issues, successes, and themes in user feedback. I synthesized the findings around common themes such as learnability, help and information design, memory burden, revoting, coercion protection, and trust in the system.

Findings

Overall, participants were able to complete the voting tasks, but the study revealed several important usability findings. The analysis uncovered themes around the system's general learnability, the effectiveness of its help and progressive disclosure design, the memory burden placed on users for revoting, the clarity of the revoting process itself, understanding of coercion-resistant features, and user trust and perceived security. I describe each of these themes below, supported by illustrative quotes from participants (quoted anonymously) and observations from the sessions.

General Learnability and Intuitiveness

Participants generally found Loki's basic voting interface learnable and straightforward for the initial voting scenario. Most users reported that they always knew what to do next and did not feel "lost" or require outside help during the basic voting process. In the post-task interviews, nearly everyone answered that they "*knew what [they] were supposed to do at all points of the process*" and had no moments where something needed further explanation. For example, one participant said everything was "*clear enough that [they] could get through*" the ballot casting without needing to consult any instructions. Another simply stated that the steps to vote (selecting a candidate, reviewing choices, and submitting) felt "*straightforward*" and expected for an online voting app. These responses indicate that the core voting workflow (Scenario 1) was intuitive for users with a technical background.

Observationally, participants were able to navigate the interface with minimal hesitation in the first scenario. Several users instinctively clicked through the process step by step, often even skipping instructional text. For instance, one participant admitted "*the first thing is that I want to click on this [vote] even without reading the stuff here*", referring to the "Before you vote" instructions on the page. This behaviour suggests the interface's primary actions (login, selecting the active election, filling out the ballot, etc.) were visually prominent and aligned with users' expectations – so much so that some users ignored the detailed guidance. While this speaks to the UI's apparent affordance and familiarity, it also meant that those participants glossed over important informational content (e.g. notes about revoting or coercion protection) presented at the start. In contrast, a few users did take time to read the on-screen explanations or tooltips, indicating a mix of usage styles – some users rely on immediate intuition, whereas others engage in more informed exploration. Crucially, even those who skimmed the instructions were still able to successfully cast a vote, reinforcing that the basic interactions were easy to learn. None of the participants made errors in marking their choices or navigating the ballot in Scenario 1. By the end of the first voting task, everyone but one was able to submit a valid ballot without interviewer intervention. In summary, the initial user experience proved to be largely self-explanatory and novice-friendly, although there is a risk that users who rush may miss context about advanced features.

Importantly, one participant did not complete the task correctly and submitted an invalid ballot by using the revoting interface. When questioned about this, they explained that, since this was a test scenario, they were curious about trying to

break the system and finding defects ("*I was like, okay, let me see if it overrides [the vote].*").

Effectiveness of Help System and Progressive Disclosure

The Loki prototype incorporated a "built-in help" system and progressive disclosure of information – for example, collapsible sections or info buttons labelled "Why is this necessary?" to explain security features. The usability study found that while these help features were in place, participants had mixed usage of them. Many participants did not need to invoke the help at all during the standard voting tasks, because the interface itself conveyed enough guidance. When asked if they used the help section, several responded that they "*didn't feel [they] needed*" to. One participant who ignored the help icon said they did so because "*everything was clear enough*" from the interface alone. This is a positive sign for basic usability: users could rely on the UI without extra instructions.

However, the study also showed the value of the progressive disclosure design for those who did seek more information. One participant, for instance, did click on the "help" and informational tips from the start; they "*read it in the beginning*", exploring the help centre sections on why certain steps were necessary. This user navigated through all the info pop-ups and confirmed that the contextual explanations were helpful and not overwhelming. The help content was described as "*quite extensive*" but accessible – "*if I wanted to know, I would find it*", one participant said of the information on invalid ballots. This suggests the help system succeeded in providing deeper explanations for those motivated to look. Participants particularly noted the system's inline guidance about the memory aids (the visual identicon and phrase used to remember a ballot) and about invalidating votes. In fact, one participant in the revoting scenario recalled seeing that information earlier: "*since I checked the help... before about the memory tags, I knew what I was looking for when I was selecting my vote*", and thereafter "*the rest of the process was quite straightforward*". This demonstrates a learning effect – the progressive information helped the user understand a concept (identifying their ballot) which they later applied without needing to reopen help.

That said, the timing and visibility of critical information could be improved. In Scenario 3 (coercion), participants were instructed that they could not click help (because a coercer is presumed to be watching). Thus, any guidance on how to handle coercion needed to be gleaned from the interface itself without the help menu. Here, a few participants struggled. One remarked that the interface hint about having "options" under coercion was too vague: "*it just says that I have options. But what options?... I guess I need to go to help*". This participant felt stuck because the system's coercion instructions were not sufficiently clear unless one clicked the help – exactly what they were told not to do in that scenario. This is an important finding: progressive disclosure went too far in hiding crucial coercion guidance. The design intended to avoid alarming users by initially concealing anti-coercion details (accessible via a help link), but in practice this confused users who were in the coerced mindset and knew they shouldn't overtly seek help. I noted during the session that this was an issue and discussed changing the UI (e.g. making the coercion hint text more prominent and less "alarming") based on this feedback.

Thus, while the help system was generally effective as a supplemental resource, the study revealed that truly critical instructions (like those for handling coercion in real-time) must be visible at the point of need. In future iterations, I plan to revise the UI so that users under duress can see a clear prompt or highlighted instruction about their anti-coercion options without having to click the help button (which they might avoid if being watched).

Lastly, I noted that the participants who did click the help buttons were most likely to click the one explaining the memory aids, which was blue, unlike the other ones, which were grey. One participant explicitly pointed this out: "maybe highlight it, not like in grey...," while another said they missed the grey ones because they did not think they would be clickable. The revised colourings can be found in Figure 3.15.

Memory Burden and Ballot Identification Issues

One of the most significant usability challenges uncovered was the memory burden placed on users by Loki's ballot identification mechanism. Because the system is coercion-resistant, it does not simply show a voter which ballot is theirs upon return – for privacy reasons, users must recognize their previous vote among decoys using memory aids (the timestamp, a visual identicon, and a unique phrase). This proved to be a point of cognitive strain for many participants in the revoting scenario. Several users expressed difficulty remembering the exact details of their ballot and picking it out from a list of many similar entries. "*Out of the multitude of ballots that were suggested, it was difficult to find the correct one,*" one participant explained, "*especially if the colours [of the identicon] keep remaining the same... scrolling through four pages to find my [memory] tag... was a bit difficult.*" Another participant concurred that the identicon pattern didn't particularly stand out to them: "*I didn't even pay attention to the picture.*" In that case, they ended up relying on just the textual phrase and timestamp, which in a long list was error prone.

Notably, participants varied in how well they remembered the aids. Some did come prepared: a few users immediately recalled their phrase or the image ("*it had something to do with spring... an arrow going down*" one user remembered, successfully finding their ballot). Others struggled: one participant admitted "*of course I forgot it*" when prompted to identify their ballot on the revote screen. Those who had been explicitly warned at the end of the first scenario to note their details sometimes only remembered one cue (e.g. just the time of voting) and ignored the others. Indeed, in the interview one participant said the date/time was the most salient clue and "*the memory aids could be good as well*" if needed. Another participant found it "*easy enough*" to recall because they focused on a combination of the colour and phrase, but still remarked that "*maybe not so much of the [identicon] pattern*" stuck in memory.

A few important usability issues emerged from this. First, memory aids may not be distinctive or memorable enough on their own. Users reported that the word phrases and icon graphics tended to blur together when scanning a long list of ballots, especially if many shared visual similarities (e.g. multiple orange-coloured icons). Second, the system's reliance on user memory could lead to mistakes. In fact, one participant accidentally selected the wrong ballot from the list – effectively

invalidating their revote – because they misremembered the time stamp by an hour. In discussing this, the participant said they "*knew*" what they were supposed to do (identify their previous vote) but "*couldn't really execute it*" correctly. This scenario highlights a failure mode: a user who understands the concept can still slip up on the details, potentially voiding their intended vote. When this happened in the test, I informed them that the ballot was invalid (after submission), but the participant noted they "didn't pay attention" to the memory cues initially and thus made the error.

The study also captured how users might adapt to this memory burden in practice. One common coping strategy that participants mentioned was simply writing down their ballot information. "*If I know that [I have to remember it], I would just write it down,*" one participant stated frankly, adding "*I don't think there is anything [the system] could [do] to help me*" remember otherwise. Indeed, a couple of users laughed that in a real election they would jot down the phrase on paper or take a photo of the identicon. While this is a rational user response, it represents a potential security risk (external notes could be discovered by a coercer or violate ballot secrecy). It underscores that the current design might be pushing too much responsibility onto human memory. One participant recommended an explicit reminder or even a practice run: "*maybe... an instruction run before the real [vote], so someone actually understands what he has to... remember*". They suggested a short tutorial or video that would train voters on the importance of noting their ballot's identicon/phrase, to mitigate the risk of forgetting after a long delay. Overall, the cognitive load of ballot identification is a serious usability concern: while the feature worked for some, others found it cumbersome or anxiety-inducing. This indicates a trade-off between security (not explicitly labelling a user's ballot) and usability. Users might benefit from either more robust memory aids (more distinctive or personalized but still secure) or alternative fallback options if they forget (for example, identity verification to retrieve their prior vote in a secure manner, if that could be done without compromising coercion-resistance).

Clarity and Confidence in Revoting

Scenario 2, which tested the act of changing one's vote, was generally completed successfully by participants, but their confidence in the process varied. On the positive side, users found the mechanics of revoting to be logically "*straightforward*" once they identified their prior ballot. The interface essentially walked them through logging in, indicating they had voted before, selecting the previous ballot, and then casting new votes. In practice, participants who remembered their ballot had little trouble: "*I have found my previous ballot and selected it, and I'm continuing to vote... submitting the vote*" one user narrated smoothly. When asked for their impression, another participant described the re-vote mechanism as "*quite straightforward*", appreciating that it followed a similar flow to the first vote. Participants also reacted positively to the concept of being able to change a vote. One noted that while this isn't part of "*normal*" paper voting, in an online system "*it felt useful*" and they could imagine people appreciating the flexibility.

However, assurance and feedback emerged as an area for improvement. Some users were uncertain whether their new vote had actually replaced the old one. For ex-

ample, a participant said they "*assume I just re-voted*" and that was that, but later admitted they were only "*pretty sure*" it counted, adding "*unless I didn't read something*". This suggests a slight lack of confidence – they believed they had done it right but weren't 100% certain no mistakes were made. A few participants explicitly desired stronger confirmation. "*Maybe it would be nice to have a confirmation... that hey, your vote was registered successfully,*" one participant said, proposing perhaps an email receipt or on-screen notification to reassure that the revote went through and is now the active ballot. In the current prototype, the confirmation page at the end of voting indicates success regardless of if the cast ballot ended up being valid or not. Some users wanted something more persistent or explicit. In interviews, when I asked, "*How sure are you that you have cast a valid ballot?*", most answered confidently if they knew they had selected the correct prior ballot. For instance, one said "*I am quite sure since I selected the [memory aids] that I remembered.*" But if there was any uncertainty about the identification step, confidence plummeted – "*I don't know... How can I be sure ever, actually? Not unless I had this written down,*" said one user who was unsure if they picked the right ballot and effectively gave up on verifying it.

Interestingly, participants' mental model of revoting influenced their confidence. Some correctly understood that only one vote counts and the latest valid vote supersedes the earlier one. Those individuals often used analogies like "*editing a submission.*" Others were initially puzzled – one participant remarked it was "*difficult to map [revoting] to the normal voting process*" because in traditional voting you cannot change your vote. With a bit of reflection, though, they came around, noting that "*in an online format it would become more likely*" for people to change their vote since the opportunity exists. This indicates that framing and educating users about the concept of revoting is important for setting expectations. During the scenario setup, I told participants to imagine a news scandal changing their mind; this narrative helped them accept why one might revote. Still, a few expressed that in a real election they might not bother to log back in unless they felt strongly – "*I think it's a good idea... but I don't know if I would care enough to do it*" one user admitted, citing personal voting habits.

From a usability standpoint, one of the clearest findings was that feedback messages need to instil confidence. The system did have an on-screen confirmation and even warnings about invalid ballots (multiple participants noted that the "*confirmation page was explicitly saying what happens with an invalid ballot*", which they found helpful). This messaging was crucial when a user made an error. For example, when a participant accidentally chose the wrong previous ballot (as mentioned earlier), the system's message that the new vote "*will not count as a vote*" if the ballot tag was incorrect, was key information. That participant realised from the prompt that their revote would potentially be invalidated. In their interview, they acknowledged the site did explain invalid ballots, but the experience still left them a bit shaken about whether their final vote was valid. The common pattern was that users found the features meant to preserve their plausible deniability to have a very detrimental effect on usability, with many expecting that a "real application" would remember their past actions. In summary, while participants generally navigated the revoting process successfully, their trust in the outcome was not always absolute. Clear, redundant confirmation mechanisms (both in-app and possibly external) could help

users feel as confident in their changed vote as they did with their initial vote.

Understanding and Use of Coercion-Protection Features

In Scenario 3, participants had to employ Loki's coercion-resistant features in a high-pressure context: they were told a coercer was watching them vote and instructing them to choose the first option for every race. The participant's goal (kept secret from the coercer) was to ensure that when the election ends, their true intended vote is the one counted, not the coerced vote. This scenario truly tested users' understanding of the system's special features and their ability to use them under constrained conditions (no overt help, needing to "act normal"). The findings show that most participants grasped the general idea that they needed to somehow invalidate or override the coerced vote, but they approached it with different strategies and levels of success.

Many participants figured out the intended strategy: casting an invalid ballot while the coercer is watching. The system allowed a user in this situation to log in, indicate they have voted before, but then select the wrong previous ballot (or otherwise fail the authentication) so that the new submission would not count. Users who understood this did things like deliberately pick a decoy ballot from the list or claim it was their first time voting when it wasn't. One participant explained their approach succinctly: "*I used the option that I have voted before, and I deliberately went for a different [ballot] of mine to invalidate my vote and act as normal in front of the coercer.*" In other words, they pretended to comply but knowingly selected the wrong prior ballot, so the coerced vote they cast would be void. This individual executed the steps confidently and, upon submission, was informed by me that the ballot was invalid. They reported that the system feedback was helpful – "*the confirmation prompt... reminds you that an incorrect selection... comes as an invalid vote*", which reassured them that their ploy would work. Another participant did something very similar: "*I chose the ballot that wasn't my previous one... that made the ballot invalid,*" they noted, showing a clear understanding of the anti-coercion mechanism. These users found the feature clever and empowering. They remarked that the site gave just enough information to clue them in (for example, a notice on the identification screen about the consequence of a wrong selection) without tipping off a hypothetical coercer. One even said the website provided sufficient info "*even while you cannot access the help section,*" because the necessary hints were embedded in the interface.

Interestingly, a couple of participants came up with an alternative strategy that is also supported by the system: fully comply in the moment, then quietly re-vote later when safe. In our discussion, one participant reasoned that there were essentially "*two options, one for good liars and one for bad liars*". By "*good liars,*" they meant those who could confidently trick the coercer by casting an invalid ballot without arousing suspicion; by "*bad liars,*" they meant those who might fear getting caught and thus would simply cast a genuine (but coerced) vote and plan to change it afterward. "*If somebody is very bad at lying, then they should just go for re-voting after this... But that requires you to know that you can re-vote,*" the participant explained. This insight was quite striking – it showed that users were actively thinking about their personal tendencies under duress and how the system

could accommodate different coping tactics. In practice, one of our participants essentially did the "*bad liar*" method: they went through the coercion scenario without attempting any trick at all, effectively submitting a normal vote for the coerced choices. In their own words: "*I'm logging in... you want me to vote for all the first ones... I submit my vote. There you go.*". When I asked them to describe how this achieved the goal, they reasoned that since the system allows revoting, they could simply change their vote at a later time or go vote in person.

While ultimately all participants understood that Loki offered a means to protect against coercion (either by immediate invalidation or later revoting), not everyone arrived at the solution without difficulty. Some needed hints or to consult information. As noted earlier, one participant was initially unsure what to do and only realized the "invalid ballot" trick after considering the help text they had previously read. Another participant hesitated, saying the situation was "*kind of unclear*" until I (as the facilitator) nudged them to think about the information provided. This indicates that the learning curve for anti-coercion features is steeper than for basic voting. It's a novel concept that users don't encounter in everyday apps, so it may require more user education. In a real deployment, this could be addressed by better up-front training (as one participant suggested, perhaps a tutorial scenario).

The users' feedback on the coercion scenario highlighted a few design improvements. One issue was that the interface's current phrasing may be too subtle. The line on the home page that implied the user has "options" under coercion was not explicit; as one person noted, without being able to click help, they would have appreciated that text being "bigger" or more descriptive. We discussed that red text might be too alarming (could tip off a coercer), but perhaps a bold or differently coloured note could strike a balance. I also noted participants suggesting that the system should prevent certain missteps: for example, one user said if they indicated "I have voted before" but then failed to actually select their previous ballot, the system should not let them continue without doing so. (Currently it does allow you to proceed and effectively cast an invalid vote if you skip identification – which is intentional for security, but confusing for usability.) This again is a trade-off: the design currently sacrifices some clarity to ensure a coerced user isn't forced to explicitly indicate anything if they choose not to. Participants understood the rationale when I explained it, but as a takeaway, I see room to tweak how the UI guides a legitimate user through identification without giving away to an observer that something is amiss, and how the UI explains the concept and purpose of plausible deniability.

Despite these issues, by the end of the sessions, every participant demonstrated at least a conceptual understanding of the coercion countermeasures. When asked in the interview if they were aware of the possibility to cast an invalid ballot, all replied yes (some even anticipated it before being told, saying "*I figured something like that was possible*"). Participants generally agreed that the website did explain the concept somewhere: "*the description is quite extensive, so yeah... if I wanted to know, I would find it*". They pointed to the help sections and confirmation messages as sources of that information. From a user's perspective, the coercion scenario was eye-opening. A few participants remarked that this is a "*really interesting idea*" and that they had never used a system that let you intentionally invalidate a vote. Even those who struggled acknowledged that "*if you explain it well before, it should be nice,*" meaning they saw the value once they understood it.

In summary, the coercion-resistance features were effective but not immediately intuitive. Participants employed one of two strategies (invalidate now or re-vote later), and both are supported by Loki, which is a positive result. Yet, the need for clearer in-the-moment guidance was evident. Observing users in this scenario provided valuable insights: I watched some users pause for a long moment on the ballot identification screen, clearly torn about what to do, and others come up with creative interpretations of the rules. These behaviours underscore that the design must account for a wide range of user tactics and stress levels. Going forward, I plan to refine the interface wording and perhaps add an interactive tutorial for first-time voters in the system, to ensure that even under the pressure of coercion, the user can confidently execute the protective measures without arousing suspicion.

Trust and Perceived Security

A crucial aspect of any e-voting system is whether users trust it – both in terms of security (privacy, integrity) and in terms of their own sense of confidence using it. In the usability study, I paid close attention to remarks that indicated how secure or trustworthy participants perceived Loki to be. Overall, participants expressed a good level of trust in the system's security features, especially after experiencing the coercion-resistance workflow. Several users explicitly stated that they felt the system protected their privacy. For instance, one participant, after the coercion scenario, said they felt confident that "the system wouldn't reveal anything about you if you clicked incorrectly", noting that even when looking at the list of ballots "you can't see that I am one of these votes". This sentiment highlights trust in the system's anonymity – the interface design (showing decoy ballots and not labelling the user's own) successfully convinced users that an onlooker or attacker could not easily tell which vote was theirs.

Participants also appeared to trust the integrity of the revoting process, albeit with some reservations as discussed. Those who completed a successful revote felt their new vote would be the one counted in the end. One user, for example, was "*quite sure*" their final ballot was valid because they followed the procedure correctly. Importantly, the transparency of the system's behaviour contributes to trust. Users appreciated that the application explicitly stated possible outcomes like invalidation. When asked if the site provided enough information about what happens with invalid ballots, one participant responded that the information was sufficient and "*explicitly saying what happens*", which they found reassuring. However, confidence wavered when participants were unsure about their own actions, namely recalling their previous ballots. For instance, the participant who accidentally invalidated their vote felt uncertain afterwards, saying "*I don't know [if it was valid]... Not unless I had [the details] written down*". This suggests that in the absence of explicit confirmations and receipts, the users' trust in the system is directly impacted by their confidence in having memorised their secrets.

Interestingly, users' trust in Loki also manifested in their willingness to accept novel security behaviours. The concept of decoy ballots and not immediately confirming one's identity was unusual, but once participants understood it, they appreciated its purpose. One participant, reflecting on the whole experience, commented that aspects which initially seemed odd "*make sense*" when considering "*privacy and*

shit", as they put it. This remark showed that users can connect the dots between an unfamiliar requirement (like remembering a phrase or using incognito mode) and the underlying security rationale, if it's communicated properly.

From an observational standpoint, trust was also evident in how participants engaged with the system. By the end of testing, many were experimenting freely. For instance, one participant tried selecting all the fake ballots just to see what would happen, essentially probing for weaknesses or hidden behaviours. The fact that users felt comfortable doing this suggests they viewed the system as stable and were curious rather than fearful of breaking it.

That said, one subtle area of discomfort was reliance on user actions for security. As noted, one participant questioned how someone who forgets their identifiers can prove their identity – "*how do you allow people who actually forgot... to do it again... having the true identity?*". This touches on trust in the system's usability-security balance. If a legitimate user fails the procedure (thus invalidating their vote), does the system provide them with easily accessible information on what to do next?

In conclusion, participants generally felt Loki was a secure system and that they could trust it to protect their vote. The perceived security was high when the system's features were transparent and when users felt in control (e.g. knowing they could re-vote if needed, or invalidate a coerced vote). The only cracks in this trust appeared when the process became confusing, where users momentarily lost confidence until it was clarified, or when the users could not recall their secrets. Ensuring that the interface clearly communicates outcomes (valid vs invalid vote) and perhaps guiding users who are about to make an error can bolster trust further. One encouraging sign is that even with some hiccups, users left with an understanding of why the system did what it did (multiple commented along the lines of "*if this is the procedure that needs to be followed, then I guess people will just need to pay attention to that*", showing acceptance of the necessity). This alignment of user mental model with security design is crucial – when users understand the reason behind a cumbersome step, they are more likely to trust the system and comply. Overall, the usability study suggests that with some tweaks to reduce confusion, Loki's UI can achieve a strong level of user trust while maintaining its coercion-resistant security properties.

On Informing the Users

The usability study suggested that, despite containing all the information needed, the majority of users would not read the entire help section. Indeed, most participants skipped even the "Before you vote" explanations on the home page. It can be assumed that if I, the facilitator, did not give them a broad overview of the concept beforehand, the users would struggle understand the novel concepts like revoting and anti-coercion.

Some participants suggested that there should be some kind of information campaign conducted, so that the users would know what they were getting into prior to even entering the website. To this end, I designed a flyer, which would be delivered to the

users' Digital Mail well before the election opens, informing them about the basic concepts of revoting and anti-coercion.

Figure 5.1: Digital flyer intended to give users a brief overview of the most important novel features. This would be distributed in advance. All dates and links are for show only and are hypothetical.

Discussion

The usability study of the Loki voting interface demonstrated the complexity of balancing security features and user experience. The primary voting task (casting a ballot) was intuitive for all participants, highlighting the system's ability to guide users through standard voting processes. However, the introduction of coercion-resistance mechanisms added complexity. These security features, including the use of noise ballots and revoting, created a significant usability challenge, particularly in tasks such as ballot identification and memory recall.

One key finding was the memory burden placed on users when they had to identify their prior vote among a list of decoy ballots. The system's reliance on a two-word phrase and a graphical identicon for recall was helpful but not foolproof. Some participants struggled to remember and correctly identify their last vote, which led to errors, such as selecting the wrong ballot or failing to use the memory aids effectively. These difficulties highlight a critical challenge in coercion-resistant voting systems: balancing memory requirements with user-friendly design. While the memory aids offered some assistance, they were not sufficiently distinctive for all users, suggesting a need for improvement in this area.

Another challenge was the understanding and use of coercion-resistance features. Although most participants grasped the concept of revoting and vote invalidation, the system's nuanced operation was not always intuitive. Participants who had not thoroughly engaged with the help system or prior instructions often struggled to perform coercion-countering actions correctly. This suggests that a more explicit, upfront explanation of these features may be necessary, as well as ongoing user education to ensure that voters understand how to protect their vote under duress.

The system's progressive disclosure of information – offering tooltips and on-demand help, helped users who were willing to engage with the interface's explanations, but not all participants made use of these resources. This reinforces the importance of user education prior to entering the voting system. Ideally, voters should have a clear understanding of how to use coercion-resistance features before encountering real-world pressures.

In terms of revoting, the majority of participants successfully cast a new vote that replaced the old one. However, while the task was generally completed correctly, some participants expressed uncertainty about whether their vote was truly valid. The lack of explicit confirmation or feedback after the revote created doubt, suggesting that a stronger feedback mechanism would be appreciated. Providing clear reassurances without alerting a coercer is not something I found possible during my

work on the project and is a potential area for future research.

The coercion scenario, where participants were instructed to vote under duress, tested the system's ability to protect a voter's true intent. Most participants successfully used the system's features to either invalidate the coerced vote or plan to revote later. The fact that some participants opted to fully comply with the coercer, relying on revoting later, suggests that the system's reliance on coercion-evasion strategies may require further simplification and clearer guidance to ensure that all users, under any level of stress, can protect their vote effectively.

Overall, while Loki's UI succeeded in guiding most users through the key tasks, there were several areas for improvement, particularly around memory aids, user education, and UI element clarity. While the study suggested that the system works well for technically literate users, non-technical users may struggle, particularly under stress. Future iterations and studies should focus on enhancing the system's accessibility and ensuring that even users without a background in IT can utilise it easily and effectively.

Conclusion

The research question of **how to design a user interface that maximizes the usability of a coercion-resistant voting system for all voters** can be answered through a balance of security and usability. The Loki interface successfully enabled users to cast votes, update them, and protect their true intent under coercion, but not without challenges. Key design goals were met, including simplifying complex security features for users, providing accessible feedback, and normalizing coercion-resistance actions to avoid alarming observers. However, issues with memory aids, user education, and feedback clarity point to areas where the design can be refined.

The key usability challenges identified in the study included the memory burden of identifying previous ballots and the need for better clarity around the use of coercion-resistance features. While the system provided memory aids, these were not always effective, suggesting a need for more distinctive cues or alternative methods for ballot identification. Additionally, although the revoting process was generally successful, many users lacked confidence in whether their new vote would count and were generally confused by the design decisions resulting from preserving their plausible deniability. To address these challenges, several design principles were employed, including progressive disclosure of information and integrating help features into the voting flow. The memory aids provided some assistance but should be improved to enhance usability, and the coercion features should be made more intuitive through upfront education and clearer instructions. Most importantly, users need a strong explanation about why the system shows them things like decoy ballots and why it appears as though it doesn't know things they expect it to know about them.

In answering the research question, this project shows that it is possible to design an intuitive and usable coercion-resistant voting interface. The Loki UI was effective in enabling users to successfully complete key voting tasks, but also revealed critical areas for improvement, especially regarding user education, memory aid design, and feedback clarity. Future iterations should focus on making the system more accessible to all users, especially those who may not be as comfortable with technology, and ensuring that all voters can confidently navigate the process under stress.

To summarise, this project demonstrates that coercion-resistant voting can be both secure and user-friendly when the design carefully considers the needs and limitations of all potential voters. With continued refinement and user testing, it has the potential to provide a robust solution for protecting the integrity of online voting systems.

Bibliography

[1]   R. Giustolisi, M. S. Garjan, and C. Schuermann, "Thwarting last-minute voter coercion," in *2024 IEEE Symposium on Security and Privacy (SP)*, IEEE, 2024, pp. 3423–3439.

[2]   ACE Electoral Knowledge Network. "Electoral integrity." Accessed: 2025-05-10. (n.d.), [Online]. Available: `https://aceproject.org/main/english/ei/eie12f.htm`.

[3]   J. C. Heckelman, "The effect of the secret ballot on voter turnout rates," *Public Choice*, vol. 82, no. 1, pp. 107–124, 1995.

[4]   L. Cristiano, R. Longo, and C. Spadafora, "Click and cast-assessing the usability of vote app," in *E-Vote-ID 2024*, Gesellschaft für Informatik, 2024, pp. 67–84.

[5]   L.-H. Merino, A. Azhir, H. Zhang, *et al.*, "E-vote your conscience: Perceptions of coercion and vote buying, and the usability of fake credentials in online voting," in *2024 IEEE Symposium on Security and Privacy (SP)*, IEEE, 2024, pp. 3478–3496.

[6]   W. Lueks, I. Querejeta-Azurmendi, and C. Troncoso, "{Voteagain}: A scalable coercion-resistant voting system," in *29th USENIX security symposium (USENIX Security 20)*, 2020, pp. 1553–1570.

[7]   R. Longo and C. Spadafora, "Amun: Securing e-voting against over-the-shoulder coercion," *Cryptology ePrint Archive*, 2021.

[8]   A. D. Baddeley, "The psychology of memory," *The essential handbook of memory disorders for clinicians*, pp. 1–13, 2004.

[9]   C. Nissen, T. Hilt, M. Volkamer, J. Budurushi, and O. Kulyk, "Voting under pressure: Perceptions of coercion and counter-strategies in internet voting," Manuscript shared by authors, 2025.

[10]   O. Kulyk and S. Neumann, "Human factors in coercion resistant internet voting–a review of existing solutions and open challenges," in *Sixth International Joint Conference on Electronic Voting (E-Vote-ID 2020)*, TalTech press, 2020.

[11]   USLegal, *Plausible deniability law and legal definition*, `https://definitions.uslegal.com/p/plausable-deniability/`, Accessed: 2025-05-10, 2025.

[12]   Vercel, *Next.js: The react framework*, `https://nextjs.org/`, Accessed: 2025-05-11, n.d.

[13]   shadcn, *Shadcn/ui: Build your component library*, `https://ui.shadcn.com/`, Accessed: 2025-05-11, n.d.

[14]   M. Palatinus, P. Rusnak, A. Voisine, and S. Bowe. "Bip-0039: English wordlist." (2013), [Online]. Available: `https://github.com/bitcoin/bips/blob/master/bip-0039/english.txt` (visited on 05/11/2025).

[15] Y. Romailler. "The definitive guide to modulo bias and how to avoid it." Kudelski Security Research. (2020), [Online]. Available: `https://research.kudelskisecurity.com/2020/07/28/the-definitive-guide-to-modulo-bias-and-how-to-avoid-it/` (visited on 05/11/2025).

[16] OpenAI. "Gpt-4o transcribe model documentation." OpenAI Platform Documentation. (2024), [Online]. Available: `https://platform.openai.com/docs/models/gpt-4o-transcribe` (visited on 05/11/2025).

Appendix

Usability Study Transcripts

The transcripts are not arranged in any order and are anonymised. I stands for interviewer and T for tester.

Transcript 1

I: Yes, alright, so I'm going to redo the script so that every single participant has the same exact scenario. So, you will be looking at a prototype of a new online voting system. The main goal is to see how easy and understandable the system is to use, and I'm looking for your honest feedback. That means that there are no right or wrong answers here. You are not being tested here, the system is. I'll be recording our session in screen and audio, and the recording is just for my internal research purposes and will be kept anonymous, but I will maybe quote you. So, as you use the system, I'd like you to try and think aloud as much as possible. That means saying out loud what you're looking at, what you're trying to do, and what you expect to happen, and what you think of what you see. This is very valuable for me to understand your thought process better. I'll be mostly observing, but I'll give you specific tasks to do. Note that once we begin, I will not answer your questions about the system. You are encouraged to use the tools and information the system provides you to find your answer. If you cannot find the answer, it is the fault of the system and it must be fixed. Can I just move this away? That's unfortunate. So, imagine this is a prototype for an online voting system that you need to use. It has some extra protection mechanisms built in, designed to help protect against voter coercion. That's when someone might try to force you to vote a certain way. One important feature is that you are able to vote multiple times to change your vote before the election officially closes. Now imagine that the election has started and your task is to use the system now to cast your votes for the candidates or issues presented.

T: So, I see the available election is for two. The only one that is active is for this one, 2025. And I have not voted before. So, let's select. I've chosen my votes. Go to the next question. Next question. And I am reviewing. The answers are right, so I submit my vote.

I: Okay, that's cool. So, before we talk about the experience, I have a quick logistical question. Would you be potentially willing and available for a short follow-up session, maybe 15 or 10 minutes, in about one or two days to test another aspect of

the system?

T: Yes.

I: Cool. So, did you feel like you knew what you were supposed to do at all points of the process?

T: Yes.

I: Cool. It was quite clear. Was there ever a moment where you felt you needed something explained to you?

T: No, not really.

I: Did the application do a good job of explaining things to you?

T: Yes, I looked at what the memory aids were, because that was sort of... I raised the question, but I could find the information on the platform.

I: Cool.

T: Did you make use of the built-in help section? Why or why not?

I: Yes, for the memory aids, not the general help function, but to just understand what it was.

T: Cool. Was there anything unexpected during the experience?

I: No.

T: Alright. Well, thanks. That's it for today.

Transcript 2

I: So, you will be looking at a prototype of a new online voting system. The main goal is to see how easy and understandable the system is to use. I am looking for your honest feedback. This means that there are no right or wrong answers here. You are not being tested here. I'll be recording our session, screen and audio. This recording is just for my internal research purposes and will be kept anonymous, but I may quote you for the thesis. Is that okay? Cool. As you use the system, I'd like you to think and try to think out loud as much as possible. That means saying out loud what you're looking at, what you're trying to do, and what you expect to happen, and what you think of what you see. This is very valuable for me to understand your thought process better. I'll be mostly observing, but I'll give you specific tasks to do. Note that once we begin, I will not answer your questions about the system, but you are encouraged to use the tools and information of the system to find your answer. If you cannot find your answer, that's the fault of the system and needs to be fixed. Okay, so the first scenario. Imagine this is a prototype for an online voting system that you need to use. It has some extra protection mechanisms built in, designed to help protect against voter coercion. That's when someone might try to force you to vote a certain way. One important feature is that you are able to re-vote multiple times or change your vote before the election officially closes. Now, imagine the election has started. Your task is to use the system to cast your vote for the candidates or issues presented.

T: I'm supposed to go and vote for a candidate? Let's see. I think I'll just read through... Before you vote, these informations... That makes sense. Yeah, okay, so that's one thing I didn't really understand, re-voting. So during the whole phase, you can keep changing your ballot? Okay. Ah, okay. Okay. Okay.

I: Don't click anything yet.

T: Okay.

I: Before we talk about that experience, I have a quick logistical question. Would you be potentially willing and available to do a short follow-up session, maybe 10 to 15 minutes in about one or two days, to test another aspect of the system?

T: Sure.

I: Cool, thanks. So, now the questions. Did you feel like you knew what you were supposed to do at all points of the process?

T: Yeah.

I: Was there ever a moment where you felt you needed something explained to you?

T: Not necessarily, no.

I: Okay. Did the application do a good job of explaining things to you?

T: Yeah.

I: Did you make use of the built-in help section? The first section, the one you see... It's this one, actually.

T: Ah, no, I did not.

I: Why not?

T: I think everything was clear enough that I could get through.

I: Okay. Was there anything unexpected during the experience?

T: No.

I: Okay. Cool. And so, the second scenario that we will continue with when we do the follow-up, it handles the re-voting, so you might want to remember your ballot.

T: Okay. I just need to remember the date and time, right?

I: Yeah.

T: Cool.

I: Thanks.

Transcript 3

I: Okay, so you will be looking at a prototype of a new online voting system. The main goal is to see how easy and understandable the system is to use. I am looking for your honest feedback. This means that there are no right or wrong answers here.

You are not being tested here, the system is. I'll be recording our session, screen and audio. This recording is just for internal research purposes and will be kept confidential. Is that okay with you? I may quote you in the thesis anonymously. As you use the system, I'd like you to try and think out loud as much as possible. That means saying out loud what you're looking at, what you're trying to do and what you expect to happen. And what you think of what you see. This is very valuable for me to understand the thought process better. I'll mostly be observing, but I'll give you specific tasks to do. Note that once we begin, I will not answer your questions about the system. You are encouraged to use the tools and information the system provides you to find your answer. If you cannot find the answer, it is the fault of the system and must be fixed. So we're gonna do scenario one. Imagine that this is a prototype of an online voting system that you need to use. It has some extra protection mechanisms built in designed to help protect against voter coercion. That's when somebody might try to force you to vote a certain way. One important measure or feature is that you are able to re-vote multiple times to change your vote before the election officially closes. Now, imagine the election has started and your task is to use the system now to cast your vote for the candidates or issues presented.

T: So I see a bunch of before you vote stuff, which I would obviously go to read, although it seems very boring. First time. Okay, interesting. And then I'm not gonna read the system requirements because that doesn't seem relevant. Gonna log into vote, I think. Yeah, okay. Secure login using incognito mode. Yes, of course. Then I log in. And I enter my user ID and shit, yeah. Then I do the general election. Which is still open, very nice. Yes, of course. Fentanyl should be legal. Yes. Like James Goodman. It's nice. And I submit my vote and I assume I'm done.

I: Oh yeah, let me just stop you right there. Before we talk about the experience, I have a quick logistical question. Would you potentially be willing and available to do a short follow-up session, maybe 10 to 15 minutes, in about one to two days to test another aspect of the system? Sure. Okay, so you might wanna take a closer look at this page.

I: So, did you feel like you knew what you were supposed to do at all points of the process?

T: Yes.

I: Was there ever a moment where you felt you needed something explained to you?

T: No.

I: Did the application do a good job of explaining things to you?

T: I'd say so, yeah. Did you make use of the built-in help section, which is the one on the top?

I: No. Okay, why not?

T: Didn't feel like needed.

I: Was there anything unexpected during the experience?

T: I didn't think anything was alone. But I mean privacy and shit, so it makes sense.

I: Okay, yeah. Thanks.

Transcript 4

I: So, imagine a major news scandal related to one of the candidates or issues has completely changed your mind. You now strongly want to change your vote, and your task now is to log back into the system and cast a new vote that reflects your changed preferences.

T: Okay. So we log in, and we do the whole thing. And authentication. Go to the election, and I have voted before. And I remember which one I cast, which was that one. And we continue voting. Yes, yes, makes sense. And then I can, I assume, cast my new vote. So, yes. Then I cast the vote for the other dude. So I just re-voted.

I: Did you feel like you knew what you were supposed to do at all points during the process?

T: If I did it correctly, then yes.

I: Did re-voting feel like an actual option that one may use, or something unusual?

T: It felt useful.

I: Okay. Was there ever a moment where you felt you needed something explained to you?

T: No.

I: Did the application do a good job of explaining things to you?

T: Yeah.

I: Did you make use of the built-in help section?

T: No.

I: Why not?

T: Because I didn't feel it necessary.

I: Was there anything unexpected during the experience?

T: No.

I: Was it easy for you to remember your previous ballot?

T: Yeah.

I: What helped you to remember it most?

T: The date and time. The memory aids could be good as well.

I: Okay. What do you think about the current memory aids overall?

T: They're quite useful. I mean, the ease is very nice.

I: What do you think about the re-voting mechanism overall?

T: Also nice.

I: Are you aware of the possibility to cast an invalid ballot?

T: Yes.

I: Okay. Do you think the website provides enough information about invalid ballots?

T: I'd say so.

I: Okay. How sure are you that you have cast a valid ballot?

T: Pretty sure. Okay. Unless I didn't read something. I think I was correct there. I think so too. Let me just... Okay.

I: So, now imagine the following situation, which is hypothetical but important for us to understand. Imagine you are trying to vote, but someone is coercing you. Maybe they are physically present, watching over your shoulder, or watching your screen remotely. They are telling you exactly how you must vote. Specifically, they insist that you must vote for the very first option listed for each question or issue on the ballot. Now, here's the critical part. You need to act normally while doing this, so you don't raise the coercer's suspicion. That means you cannot obviously click on or read any help sections or information buttons, especially anything related to coercion while they are watching. However, your secret goal is to make sure that when the election finally concludes, it's your own secretly intended vote, or the one you truly want, that actually gets counted, not the coerced vote you are about to cast.

T: So, I assume that I already voted. Yeah. Okay. So, I log in and do the whole thing again. I say I've already voted, and then I choose my previous vote, which is not correct in this case. So, the ballot should not count. Choose all the options they want me to. And I submit. And that should be enough.

I: Okay, thanks. Can you explain in your own words what you did?

T: I just chose the ballot that wasn't my previous one.

I: Okay. Do you know what that did? Yeah, that made the ballot invalid.

T: Okay, okay.

I: Does the website provide you with enough information even while you cannot access the help section?

T: Yeah. Cool. Thanks.

Transcript 5

I: So imagine a major news scandal related to one of the candidates or issues has completely changed your mind. You now strongly want to change your vote. Your

task is now to log back into the system and cast a new vote that reflects your changed preferences.

T: So, logging in, vote again. So after I meet ID, I'm selecting the election that is active. Since I voted before, I select the option for the... Yes, I voted before. And now I'm trying to identify my previous ballot. I have found my previous ballot and selected it, and I'm continuing to vote. So I'm changing my vote now. And I'm submitting the vote. Yes. Finishing and logging out.

I: So did you feel like you knew what you were supposed to do at all points during the process?

T: Yes. I think it was clear.

I: Did revoting feel like a natural option that one may use or like something unusual?

T: I find it difficult to map it to the normal voting process. So maybe in an online format it would become more likely to change your vote, since it's more accessible.

I: Got it. Was there ever a moment where you felt you needed something explained to?

T: Not really. I think the information about the memory tags were good enough.

I: Did the application do a good job of explaining things to you?

T: Yes.

I: Did you make use of the built-in help section?

T: Not this time.

I: And why not?

T: Since I checked the help function from before about the memory tags, I knew what I was looking for when I was selecting my vote. And then the rest of the process was quite straightforward.

I: Was there anything unexpected during the experience?

T: No, not really.

I: Okay. Was it easy for you to remember your previous ballot?

T: Easy enough, but I think out of the multitude of ballots that were suggested, it would be difficult to find the correct one, especially if the colors keep remaining the same. Like scrolling through the four pages to find my tag and having seen a lot of other orange tags around was a bit difficult.

I: Got it. Was it easy for you to remember it?

T: It's a cumulative color and the text that was attached, maybe not so much of a pattern.

I: What do you think about the current memory aids overall?

T: I think they're quite good, yes. Again, I think not a lot of focus is placed on the pattern.

I: What do you think about the re-voting mechanism overall?

T: I think it's quite straightforward. Maybe it would be nice to have a confirmation on another platform that, hey, your vote was registered successfully or not.

I: Are you aware of the possibility to cast an invalid ballot?

T: Yes.

I: Do you think the website provides enough information about invalid ballots?

T: Yes, the confirmation page was explicitly saying what happens with an invalid ballot.

I: How sure are you that you have cast a valid ballot?

T: I am quite sure since I selected the memory tag that I remembered.

I: Do you want to do a heads up of thirds now? So let's just go back and let me just refresh the test. Imagine the following situation, which is hypothetical but important for us to understand. Imagine you are trying to vote, but someone is coercing you. Maybe they are physically present, watching over your shoulder, or watching your screen remotely. They are telling you exactly how you must vote. Specifically, they insist that you must vote for the very first option listed for each question or issue on the ballot. Now, the critical part is, you need to act normally while doing this, so you don't raise this coercive suspicion. That means you cannot obviously click on or read any help sections or information buttons, especially anything related to coercion while they are watching. However, your secret goal is to make sure that when the election finally concludes, it's your own secretly intended vote that actually gets counted, not the coerced vote you were about to cast. Go ahead.

T: So I'm logging in to vote again. And since it's obvious that I voted before, I select the same option. However, this time I'm going for a different memory tag.

I: Okay.

T: And continuing to it as normal, redefining my votes. And then reviewing and submitting the vote.

I: Okay. Cool. Can you explain in your own words what you just did? Which anti-coercion mechanism you used?

T: Yes, I used the option that I have voted before, and I deliberately went for a different tag of mine to invalidate my vote and act as normal in front of the coercer.

I: Does the website provide you with enough information even while you cannot access the help section about this?

T: Yes, I think the confirmation prompt helps a lot with that. It reminds you that an incorrect selection of your tag comes as an invalid vote.

I: Cool, thanks.

Transcript 6

I: Okay, so you will be looking at a prototype of a new online voting system. The main goal is to see how easy and understandable the system is to use. I'm looking for your honest feedback. This means that there are no right or wrong answers here. You are not being tested here. I'll be recording our session, screen and audio, but the recording is just for my internal research purposes and will be kept confidential, but I may quote you for the thesis paper. Is that okay with you? Yeah. As you use the system, I'd like you to try it and think out loud as much as possible. That means saying out loud what you're looking at, what you think you're trying to do, what do you expect to happen, and what you think of what you see. This is very valuable for me to understand your thought process better. And I'll be mostly observing, but I'll give you specific tasks to do. Note that once we begin, I will not answer your questions about the system. You are encouraged to use the tools and information that the system provides you to find your answer. If you cannot find the answer, it is the fault of the system and it must be fixed. So, this is a prototype for an online voting system that you need to use. There are some extra protection mechanisms built in, designed to help protect against voter coercion. That is when someone might try to force you to vote a certain way. One important feature is that you are able to e-vote multiple times to change your vote before the election fully closes. Now imagine the election has started, your task is to use the system now to cast your votes for the candidates or issues presented. So, go ahead. There's a mouse.

T: I want to log in and here I have secure screen. Use incognito mode to protect your privacy. I don't use no record. I'll just go with the log in with mid-ID. This is just a picture. Sorry? This is just a picture. I'll just continue. So, that's available in the election. So, I want to enter the election here. Have you voted before in this election? No, this is my first vote. Your vote will only be counted if you provide correct information about your voting history. So, this is correct. So, it is my first vote because I'm 18. Nice. Cast your votes. Parliamentary elections. Vote for the party you wish to represent you in the parliament. I don't know. We'll go Social Democrats because they are the best in Slovakia. Next, cast your votes. Legalization of fentanyl should sail. Of course. Next, cast your presidential election. The first guy. And review. Okay. Confirm. Yeah. Everything looks just the way that I input it. So, fine. Vote successfully cast. Your vote information. If you plan to re-vote later, you'll need to identify this ballot by the date and time shown below. Okay, so I think that I need to remember this. Please take note of this information. So, I'll write it down. So, it's 10.04.

I: Can I just ask you, before we talk about it, could you potentially be willing and available to do a short follow-up session in about one or two days to test the e-voting aspect of the system? Okay, perfect. So, did you feel like you knew what you were supposed to do at all points of the process?

T: Yeah, I think it was pretty clear. So, like, yeah. Like, essentially it took me maybe like four or five clicks to log in and then to vote for the three different map parts. So, yeah, I think that everything was clear. And also, I like the red dialogues or the red information. So, yeah, I think that everything was clear.

I: Was there ever a moment where you felt you needed something explained to

you?

T: No, not yet.

I: Okay.

T: Everything was clear.

I: Did the application do a good job of explaining things to you?

T: I would say so, yeah. Like, everything that I needed was there. So, yeah. No improvements.

I: Did you make use of the built-in help section?

T: No, I did not. I didn't need it. Because, I mean, I could just follow the instructions that were provided to me, like, just where they were. So, I didn't need to use the help.

I: Was there anything unexpected during the experience?

T: Maybe the mid-ID, but that's also, of course, not the point of the UI.

I: All right. Well, that's about it for today.

Transcript 7

I: Yes. Alright. And all the information should be on the websites for you, so I will actually not answer any questions, but you should kind of have to figure out what you have to do from the website alone. Okay. So the task is just to log in and cast your vote. Okay. And I mean, I can go in and check all of these before? Yeah, yeah, absolutely. And it would also be really helpful if you kind of spoke out loud about what you're looking at and what you think is happening.

T: Okay. Ensure you are in a private environment. What does that mean? I hope I'm just watching all I show, but this doesn't make sense. Your electorate is not being monitored or recorded. It's pretty easy to find out. So what is it that you want me to do now? It's just log in. Left click. Oh, okay. So with my real?

I: No, it's just a picture.

T: It's just a picture. I didn't know how far you wanted me to go. This page would have been... I'll just go, okay. Just read the text question. That would be... Um... I might click the login button.

I: Oh, please don't actually do this because the server could be busy. It's just a little quick look because... I was in my... Okay.

T: Okay. Before proceeding, using a cognitant mode ensures no browsing. Okay. Um... Filter by... I guess it is... Apparently I voted before. Oh, you just kind of have to keep track of it. So let me just check it. I'm not sure if I'm going to be able to do this. Okay. Christian. Oh my god. I will check that one. That is so obvious. Legislation of... Should the sale... Oh, wait. Okay. Okay. I have no idea who they are, but here we go. Oh, come on. I'm not going to click all of them, but I think it's a relevant selection of help center things. Okay. Yeah, I think the... In the beginning, it's about the coercion thing, but it also provided that help. What

to be afraid of or what to be aware of in the voting situation. [Note: The user here wrongfully thought the decoy ballots were actually those cast by the testers before him. He then wrongfully clicked a bunch of ballots and thus submitted an invalid vote.]

I: Yeah, got it. And did the application do a good job of explaining everything to you?

T: I mean, the questions themselves were straight and accurate, easy to understand, right? Kind of what you get used to by now, I guess.

I: Right. Did you make use of the built-in help section?

T: I guess I saw you. I guess I did. So, yes.

I: And why?

T: More to get... It was not that I had a need to read the help, I felt, but sometimes it's also like just out of pure interest to kind of get maybe a more deep understanding of what kind of questions could you ask, and then like, oh, maybe I didn't think of that, just to be more aware of the tool or the process itself.

I: Yeah. And was there anything unexpected during the experience?

T: No, I don't think so. Okay.

I: Well, the thing that I saw actually wanted to ask you if you had voted before in this election, it always shows like no or yes, because it's supposed to be kind of plausible deniability. Yeah. So even if you haven't, there will be an option that you have so that if there's somebody behind you, the application can't reveal any information about you. And the thing I saw you click was you clicked you did, which is incorrect. So actually your vote was not counted because you provided incorrect information.

T: Okay.

I: And why do you think you, I guess, decided to click that?

T: Yeah, I mean, when I... Actually, because we skipped this MitID and then I thought, okay, so this is just about test data and you have to run this on other persons, so there's data. So I guess I'm playing the role of a person who has done this before. So I wanted more than just to fill out a blank completely from the start. I was like, okay, let me see if it overrides. I haven't gotten to that part yet because now I just have the new key phrase or what do you call that? Yeah, this olive thing.

Transcript 8

I: Okay, so just for the record, you do consent to me recording you and anonymously quoting you?

T: Yeah, of course. Are you recording the screen as well?

I: Yes.

T: Okay, perfect. So I have a task here. This is to log in, I guess. I'm logged in? No. No, okay. Okay, perfect. Just to make sure... Should I also read it out loud? Okay, look at it. Perfect. Okay. Yeah, okay. What if I forget what I have? What was my ballot? Okay.

I: If you have any questions, try to use the website.

T: Yeah, I know, I just think I did a lot, so... Okay. Okay. Okay. Okay, so it's just making sure that I'm not correct while the page is up. Okay, not that the physical ballot is consistent. Okay. Okay. Okay. Okay, but that would invalidate my vote here? Or like, is there a system to make that for sure? Because the one, the physical ballot is supposed to be anonymous as well. So how do you discard it?

I: Well, I guess they can check.

T: Okay.

I: It's just that when you go to your ID, so it's not the ballot.

T: Yeah, they take you, yeah, they get discarded later on. Okay. Perfect. I forgot, sorry. Okay, perfect. I need to answer some particular requirements, which are... MitID, which is your accommodating station. Also application requirements, smartphone with MitID. Okay, I will take that out, I guess. Application requirements, physical requirements, application requirements. Okay. Okay, yeah, that's what I was... Okay, opening incognito mode. I guess in incognito mode to protect your privacy. Okay. Okay, now what this is basically the same, the same help. Okay. Avoiding both keeps no record. Okay. I was just doing this because... Oh, okay, is that for the...

I: It's just a photo, because you need to be registered with the Danish government to submit it. So this would be there, but it's just...

T: Fair enough. Look at elections. Oh, so I can see the results from the previous case, yeah. But it's nice that I can see what happened before. Your archive elections. So there should be a list here of how the previous elections went. To take that into account if I want to apply. So in my end, party A fucked up and they were in the government, I can remember. Your party will recount, and you provide the correct information about your voting history. Okay. Isn't this kind of tricky, so the system take into account if it's your first or not on its own? I will try later on if this is... I mean, this is my first vote, so... Perfect. New Liberal Party, Green Party, Christian Conservative Union, Change... I mean, I'm not really into Danish. I think these are the ones in the government. It's English, they're Danish. Okay, I mean... To the same position, I guess. If you ballot the car, if you fail, you get in and out. I mean, certainly for many applications, kind of. But I would say in general, no, it's too addictive. I'm not going to make jokes, so... Okay, is this a good man? So, no, okay, submit vote. Number A's, what are these? Okay, that's perfect. Could you identify the constituencies, specifically if you ballot, and identify the bottom on many others if you need to re-vote? Okay, so there is one for every combination, I hope?

I: Yeah.

T: Okay, that's nice. Can this be used later screen, the arrow down, I guess, or

whatever this is? Can I use these to actually take it into account? So if I return to the front page?

I: No, it's just... Okay, so you can meet on Friday?

T: Yeah, yeah, yeah.

I: Okay, good.

T: So we can do the e-voting on Friday. Ah, okay, because I thought I would try the re-voting now.

I: No, no, no, no.

T: So can I try to remember it or do whatever you have to do? No, it's fine. I think I will remember.

I: Okay, perfect.

T: I think you will remember, so...

I: I'll ask you some questions now.

T: Yeah, sure.

I: Okay, so did you feel like you knew what you were supposed to do at all points of the process?

T: Yeah, pretty much. It was explained and I mean, in case I was kind of explained, you had the help button.

I: Was there ever a moment where you felt you needed something explained to you?

T: Yeah, when I started voting, I think the system should be, well, explained, but I think the system should know if it's the first vote with the MitID or not.

I: It's actually on purpose to kind of preserve your plausible deniability.

T: Okay, okay.

I: So do you think that should be explained better?

T: A bit more, because for me it was weird that I had to specify it was my first vote.

I: Right. Yeah, because... I have something similar. Wait, if I can just show you here.

T: Yeah, of course.

I: It's like if you go here and you don't click anything, then it's just like you're seeing this notification regardless of if your choices were correct or not. Because the system should know, but it doesn't, it can't reveal anything about you. Because anything it tells you, it also tells the coercer behind you.

T: I see, I see.

I: So you think there should be like, you're seeing this regardless of if you have voted or not?

T: Yeah, exactly.

I: Okay, that's good. Let's just... Okay, and did the application do a good job of explaining things to you?

T: Pretty much, like I think it's really, really interesting that they give you the codes, like the... I guess it was little spring and the arrow down. Having these codes also helps in case I need something, well, we're gonna repeat it on Friday anyways. But also on the help system, maybe... Yeah, you see it's really fine. Like I was thinking maybe that you could have it on a different setup, like this at the beginning, but I think it's most people who actually will know how this works can just directly vote, so it's fine.

I: Yeah, I get it. Did you make use of the built-in help section?

T: Yeah.

I: And why?

T: Because it's my first time using the app and I had no clue about basically how this should work. So I think it's important to know because many times you have issues because, I don't know, well, meeting it doesn't work with if you don't have Chrome. And that's a headache because if you don't use that on your phone, then you're basically cooked.

I: Makes sense. Was there anything unexpected during the experience?

T: Not really. I mean, it worked.

Transcript 9

I: Just for the record, are you okay with me recording the screen? And then I may quote you anonymously in the thesis, but then everything is anonymous. Okay, thank you. So your task is to log in and vote. Just kind of a picture, because you need the government approval for that. Just going to ask you, are you in tomorrow? Would you be willing to do kind of a second round where you change your vote? It is kind of finished, but you should remember what it tells you to remember. Let me just take a note.

T: Should I take a screenshot or something?

I: Would you do that in real life? Because you can do anything.

T: Should I take a picture?

I: Go for it. [...] Okay, perfect. Thanks. I'll just ask you a couple questions.

T: Should I finish because I want to come back?

I: It's already saved.

T: Okay, nice.

I: Let's click this. Okay, nice. So do you feel like you knew what you were supposed to do at all points of the process?

T: Yeah, I think so. It was obvious and with some explanation.

I: Was there ever a moment where you felt you needed something explained to you?

T: No.

I: Okay, nice. Did the application do a good job of explaining everything to you?

T: Yeah, but just the last step. I had thought to, what is it, finish the logout or should I stay there as I asked you. Because it was not obvious to me if I could change my vote afterwards if I pressed the button to finish it. [User ignores the big green checkmark saying Your vote has been recorded successfully]

I: Yeah, no, you can change your vote up until the end of the election actually.

T: Okay. So because sometimes in some web pages when you have it like save it for later, you don't submit it.

I: Okay.

T: So that was my doubt because of that I didn't press the last button.

I: Got it, okay.

T: If there is any explanation to, yeah, finish it because afterward you could come back and change it. It's okay, then it will be safer.

I: Okay, yeah, that makes sense. I saw you didn't make use of the built-in help section, why not?

T: I don't know, I didn't feel... Didn't feel like you needed anything.

I: Okay, yeah, that's good. Was there anything unexpected during the experience?

T: No.

I: Okay, cool. Yeah, thank you so much.

Transcript 10

I: Just for the record, is it fine if I record the screen and the audio, but it's going to be anonymous? If I quote you, it's going to be just text, anonymous?

T: Yeah, sure.

I: Okay, cool. So yeah, what you have to do is kind of use the system to cast your vote as if you would in an election.

T: Okay. This is stuff happening?

I: No, no.

T: Yeah. The first thing is that I want to click on this even without reading the stuff here. But it's stated here, but before you vote, right? I'm not sure if I click here, will it disappear? Will I still have a chance to... Yeah, that's a comment, kind of. Yeah, kind of all this stuff that monitor recording in the public space. No one is watching at the moment. Yeah. This system allows you to close the voting

period. That means that if I vote now, right, I still will be able to change my mind until midnight, I guess, or something. Okay, so that's actually the protection authentication requirements. All right. Yep, yep, yep. So that's the only thing. Maybe I won't even know about this at least. Maybe I will. Yeah, depends on the knowledge, right? Secure login. Yes, Mit-ID. But your browser does. Yeah. Aha, so it's another page where I need to do... Yeah.

I: Just don't actually do this, because for the test I need to save a cookie, and it doesn't.

T: You're already standing behind my shoulder telling me what...

I: Yeah, this wouldn't be the case in a normal thing, but yeah, it's just with this.

T: So what do I do now? Do I really...

I: No, it's just kind of a more continue button.

T: Yeah, you're right.

I: I was thinking you might have dragged instead of just clicking.

T: Look at mine, the next page. These are mine, right? Yes, mine. The results. I can see my results. But do I really need to see this? Should I see this? Even archived. What is the difference between past elections and archived? I guess the first time. So it's like previous years. This is, I guess, maybe the past. So new results from previous elections may be in parentheses or something like for which periods. I mean, there's no any difference, at least for me now, archived and past. This is still archived, right? Yeah. Okay. Yeah, I guess you need to show that it's here. So here actually the same help, right?

I: Yeah, it's the full one. It's even bigger.

T: Yeah, okay. What about before this election? Why is this necessary? If you provide some good information about any previous, do you want it? Ah, so there's a check. Yeah, what about before this election? Yeah, what if? Yeah, so now I have a, yeah, of course I forgot it. So this is where I'm putting my vote, I guess, right? Okay. It's cool. I should disable position. What? What? What is fentanyl legalisation? Some drafts? Aged and above. I don't know what it is. Normally when you have this ballot sheet, you also describe what is, I mean, I guess it's up to every party and person to put a history or is the party deciding what are they for, what did they do.

I: I remember from when you go vote in the Czech Republic, you get a mail of kind of like all the candidates. Description. Yeah, but then when you actually go there, it's just names.

T: Yeah, so you kind of already know what is behind this party. Yeah. I mean, I would assume some people go on the election without even knowing what's the situation. No, I don't think they would be treated the same if they would do that. I don't know. I mean, I've never done the online, but the physical ones I have, the physical, they are printed, right, and they have a description. You'd like actually. Okay.

I: In my country, it's just checkboxes with names.

T: Yeah. In the party. Yeah. It's all good, man. Review. Back to questions. I'm giving back to a little bit of a vote. Yeah, but yeah, kind of okay, I guess. If you plan to run your ballot in time, it should. By the date and time. Shown below. That means that I need to remember these are.

I: That's kind of just help you remember.

T: Yeah, that is what I mean. But I still will forget the picture. I mean, I would forget. In what phrase are you telling? Yeah, all right. Finish and log out. Okay, cool. See?

I: This is just my computer, it's not part of it. I'll just ask you a couple of questions then. Do you feel like you knew what you were supposed to do at all points of the process?

T: That I knew what to do at every point of the process. Was it like... Yeah, I guess it was.

I: Okay. Was there ever a moment where you felt you needed something explained to you?

T: There was a moment, right? Just a little bit.

I: Like anything specific you can think of?

T: No, but I mean, I guess if I would be doing this on my own, I would figure this out.

I: So you think the application does a good job of explaining things to you?

T: Yeah.

I: Okay. And yeah, so you skimmed through the help section. I was supposed to ask, did you make use of it and why or why not?

T: Yeah, I read it in the beginning, right?

I: That's the whole help center. So you clicked on all of the buttons, like "Why is this necessary?". Which just opens a part of the help center that talks about that. And do you think that was good? Or helpful?

T: So here actually the same help, right?

I: Yeah, it's the full one. It's even bigger.

Transcript 11

T: So, okay, just to change the order, because I have been here before. Okay. So definitely I should better modify. If you want to vote for this election... Yes, I... Actually, now it's just asking me to click on this one because I have already been here, right? What happens if I do this? No, it's just... I guess it won't be counted. Okay. I have some data here. What was it? Salient. This is 20th. Yeah, this is confusing actually, right? I mean, I don't know if it's someone else's things, like these ballots or... I can filter, of course. But still, I can see the rest of the... Is

it some... So I can see the others kind of ballots, I guess. Can I just ask, I mean, this... Yeah, you're right. Yeah. Maybe highlight it, not like in grey, but... Okay. Not even the black, but this is something important. It's like...

I: Yeah, I guess I should...

T: How do I identify my ballots? Yesterday. Yeah. Exactly, this is the... You can always vote in person at your local polling station. Yeah, but then how does it count? I mean, you kind of vote it, then you want to re-vote, you want to modify, then you come back to polling station, you just use like paper.

I: Yeah, it's also explained actually. It's... I think if you scroll maybe here... You can vote at your local...

T: I find on [?], always count it, regardless if you voted online first. Hmm, interesting. That's what it's the same. Can I see other information? Can you do it like that? Does it mean I have to choose all of them? I mean... You have to choose all your previous ballots. All the previous... Not only the last one. No. Okay. So that was... Can I actually... Yeah. Hmm. Yeah, this is confusing actually, right? I mean, because of this warning, now I'm in doubt. Did I... No, you did. No, no, but I mean, the feeling. Yeah. Because of all these warnings here. Yeah. Did I succeed? Maybe I should go to my local place and vote.

I: Yeah, it's actually a big issue and there's no solution. The only thing I could think of was the local voting thing, which also... It wasn't in the design that they proposed. That's something I thought up.

T: Yeah, I think if it's already have kind of integration with a MitID, for example, in online authorization service, maybe it can also have a kind of... What do you call the... Submission, like the notifying element, like it would notify you somewhere on your government email address, like e-box or here or somewhere else.

I: Everything the website tells you also tells the coercer, potentially.

T: It tells what?

I: It tells the coercer. Anything it tells you, it potentially tells the coercer.

T: Okay. So that's the issue.

I: There's also a third scenario, but I don't know how pressed for time you are. It would be a short one.

T: Yeah, that's fine.

I: Okay. So the third scenario is, yeah, there's a coercer behind you. So imagine me, I guess. And yeah, I'm here. I'm telling you how to vote. I saw the, you know, I saw your vote or something, but I'm telling you, I have a... I'm threatening you and I'm telling you, you must re-vote and vote for the first candidate or the first option on the list. And you have to act normally while doing this, so you can't raise any suspicion. So you can't click on anything obvious that says anything about coercion or read any help sections or click any information button because I'm watching. So your secret goal is to make sure that your actual vote is the one in the system once it closes. So go ahead.

T: I'm not really experienced with this system, right? So I don't want to cheat. Yeah, but is it like the first time you're coercing me or like, I mean...

I: No, let's say I saw your vote.

T: You already saw my vote that I voted for something else. So I can't choose this option. Okay, now I need to remember when I voted before. Yeah, that was just recently and I was yesterday. Yeah, I cast the date, I'll find my date. Yeah, but it was something like here, I guess.

I: Okay, so can you explain just in your own words what your strategy was to achieve your goal of your actual vote being the last one?

T: I was trying, yeah, I was trying to choose like wrong memory aids, I guess, and cast date and time. So that I knew that if I choose it, then the vote won't count, right? That's how I already know.

I: Yeah, and this one would not count. And do you think, like, did you feel pretty confident doing that? Like, do you imagine yourself being confident about your ability to kind of evade the coercion in such a scenario?

T: I guess, yeah, I guess, yeah.

I: Yeah, in light of this, what do you think about the security features? Does it feel like a secure system?

T: Yeah, particularly with that one, right?

I: But like overall.

T: Yeah, yeah, I guess. I guess.

I: Okay, nice. Yeah, I think that's pretty much it. That's all.

Transcript 12

I: And just for the record, I'm going to record the screen and the audio, but if I quote you, it's going to be anonymous. Is that fine?

T: Sure, yeah.

I: Okay, perfect. So go ahead.

T: Okay, so what do I have here? Log into Vote and all that stuff. They want me to vote for this.

I: You can, you don't need to.

T: Okay, so just for that. Let me take a look. Mm-hmm. So I should... What?

I: You can right-click a button to do that, but don't actually do it here. Because for the test, I need to save a cookie in my browser, and Incognito doesn't.

T: Okay, but I will not be able to log in with MitID right now.

I: No, it's actually just a picture.

T: Oh.

I: Because you need the government if you want to do that. Yeah. But in a real application, it would be there.

T: Okay, so I'll just click continue, I guess. Yeah. Mm-hmm. So I have voted.

I: I think you dragged it a little. You need to click it precisely.

T: Oh, man. I didn't even know. Strange. It's like completely random stuff. Yeah. Legalization of finance. Wow. I don't know. I don't even know what it is. Mm-hmm. So is it normally possible to re-vote?

I: In Estonia, which is like the only country where they have online voting, it actually is.

T: Okay. So this is like a new feature.

I: Kind of. It's supposed to be an anti-coercion feature.

T: It makes sense so that you are pressured by somebody and then you can do it in secret for not remembering your part.

I: Can I just ask you, are you here Monday?

T: Yes.

I: Okay. All right. We can do the continuation on Monday then. So maybe I should...

T: What do you mean continuation? Is there more?

I: There's a second scenario where you want to re-vote. It's actually like where most of the issues are found.

T: Yeah. Will it take a lot of time then?

I: No, it's also like five minutes.

T: Okay, good.

I: But it's about like remembering the things because if we do it now, it's right there at the top.

T: That's right. So we can do it on Monday.

I: Yeah, sweet. Let me just take a note of your number. Your number nine.

T: Everything is clear. Looks nice.

I: Nice, thanks.

T: Just the problem with the button, I guess.

I: Why you need to click specifically?

T: Yes, like you do this and then it doesn't go through.

I: Yeah. And then I see people doing like, fuck, fuck, stop. Even if you do a little, I don't know if it's just the mouse, because like this, yeah, it is possible. But I think that happens like everywhere. Even if you go and like, oh, it's not. But it doesn't go through.

T: You're trying to drag it now?

I: Yeah, it's like what I see people do is like they click and then it doesn't go through because they drag it.

T: Oh, yeah. Okay, but like the problem with me was that I think I didn't click in the other place. Yeah, I think it was here when I clicked here. Maybe not.

I: I think it is recorded. Yeah, it doesn't really matter. Anyway, now the questions. Too much shit. Yeah, so did you feel like you knew what you were supposed to do at all points of the process?

T: Yeah.

I: Sweet. Was there every moment where you felt you needed something explained to you?

T: No, it was some extra.

I: You think the application did a good job of explaining things to you?

T: Yeah.

I: And I saw you didn't make use of the help section. Why not?

T: Which section?

I: This help thing.

T: Oh, no, because I didn't need it.

I: No?

T: It is really straightforward.

I: Right, okay. Was there anything unexpected during the experience?

T: Only the thing with the button.

I: Good.

T: What is here? How to vote? What are the differences? Can I vote multiple times? Are my votes private? Yeah, maybe that would be concerning because I don't know about the IP address. Can you retrieve it? Like, all of those evaluations are supposed to be anonymous and if they are actually, I don't know.

I: Yeah, true, true. Alright, sweet. I think we're going to, like, if we do it on Monday, the continuation, that's like where the hotspot is because I tried to make it as simple as possible for the first time, but then there's like for the actual re-voting and stuff, there's a lot more things that they designed for security and I had to kind of dance around that and I don't know if I did a good enough job or not.

T: Okay. Yeah, cool.

I: Sweet, thanks.

Transcript 13

I: Yes, so just for the record, I'm going to record the screen and your audio, but if I quote you, it's going to be anonymous, just textify.

T: Nice, got it.

I: So here you go. Your task is to use the online system and vote.

T: Okay, so my task is just to vote right now?

I: Log in and vote, yeah.

T: Okay, I can just go continue. Okay, this is a mock-up. Okay, let's see. Okay. Okay. Okay, so... Okay. Okay, cool.

I: I'll just ask you, did you feel like you knew what you were supposed to do at all points of the process?

T: Yes.

I: And was there ever a moment where you felt like you needed something explained to you?

T: No, just the flow of things represented, but it was quite clear, yes.

I: Okay. And you think the application did a good job of explaining things to you?

T: Yeah.

I: I saw you didn't make use of the built-in help section, why not?

T: Because maybe, but this is the test bias, I knew what I had to do.

I: Got it. Was there anything unexpected during the experience?

T: No, straightforward.

I: Okay, cool. Let's try doing both scenarios at once.

T: It's probably, I can't ask you much about remembering stuff, but, you know, let's see how it goes.

I: All right, so second scenario is... Imagine a major news scandal related to one of the candidates or issues that's completely changed your mind, you now strongly want to change your vote. Your task now is to log back into the system and cast a new vote that reflects your changed preferences.

T: Okay. So, let's do this. Cool. Yeah, okay.

I: I mean, I heard you say you were kind of lost, what kind of was the thing that was surprising?

T: Yeah, I think the first thing I didn't know was politics. But then I, like, maybe because I rushed the previous process, but I actually didn't, let's say, I didn't look for, I mean, I didn't remember that I needed to remember this. I didn't realize that I need to remember this in terms of re-voting, but I also didn't know that there was a possibility to re-vote before starting to vote. So maybe, maybe the issue is that it's

me being a user of this system for the first time, and I didn't know that I can re-vote afterwards. So I think that was the issue, and maybe, and this is hard to actually blame on UX, I think this is more of the, how it works. So maybe, maybe it should be, you know, sometimes you have these wizards when you, for example, install something new for the first time. Maybe it should guide you through somehow, actually, when you press next, and maybe, let's say, the initial step, initial process is quite straightforward and easy, but then when you register, maybe there should be like a, the screen should go blur, like blurred a little bit, and you should highlight before going next, if it's the first entry, you should highlight the fact that if you want to re-vote, because that's a possibility, please remember this. So that is my thought, maybe I missed it because I rushed, but that would be my opinion.

I: I just want to show it to you again, like the screen that we just talked about. Like this want mode, you change about it.

T: Yeah, like this, this is confusing in a way that it's red, it sounds like an, like it looks like an error that something happened, and it doesn't look like an info I should remember afterwards, so maybe this should be as a, maybe a different color, and maybe in a different place, maybe like if you go down, like this is quite cool, this is actually nice, and I think this one, this one creates confusion in terms of like, it looks like you made something bad, but actually, okay, so please take note of this information, I would change the color maybe, but this is a detail of course, like this is nice, this corresponds well because you go down, maybe it should also stand out a little bit more than the gray to catch the attention more, because before you press this one, or maybe you could leave it like this, remove this, click finish and logout, and then a pop-up could be, like a double confirmation could appear here.

I: But maybe, the thing is, it's like, I had it like this, but then one of my supervisors was like, oh, it's not clear enough, you need to have something more in the area, right, add this shit, but then it starts confusing people, but it's also, it's good because then I can do like a final iteration with this presentation or something. Yeah, did you feel like you knew what you were supposed to do at all points of the voting process?

T: Yeah, yeah, I mean, I think the first, let's go back here, okay, let's say I want to re-vote, log in to vote, yes, yes, log in, and here I would rather have something, because this looks like I'm here the first time, I think I'd rather have like available elections, past elections, and in the past, maybe it shouldn't be, maybe it could be depreciated somehow, that instead of available, you could have, for example, I don't know, yeah, maybe available is a good one, but then like past, or if you have this one here, if you already made the vote, you should have re-vote instead of enter election.

I: Yeah, but it's on purpose that it doesn't do this actually, and yeah, we can explore that a little later.

T: That would be my idea, but if that's justified, that's fine.

I: Yeah, so did re-voting feel like an actual option that one may use during the election process, or like something unusual for weird people?

T: Yeah, I think when you, like back home when you vote, you cannot re-vote, so,

but then if that's provided, if this provides an option for this, then okay, but for me it felt weird because I would never, I would never know that you can re-elect, I mean re-

I: Yeah, was there ever a moment where you felt you needed something explained to you?

T: Not really.

I: Okay. Yeah, same thing as before, kind of, was there anything unexpected during the experience? I guess we kind of touched on that, like re-voting. Was it easy for you to remember your previous ballot?

T: No, because I didn't realize before, but this is again hard to actually, hard to tell who should be the one providing that info. Of course, UX of the app should somehow let you know, but I also maybe rushed it, and maybe that's the reason, because it was my first time doing this, so maybe.

I: Got it. What do you think about the memory aids that the application provides you, as in the two words and the identicon?

T: Again?

I: What do you think about the memory aids the application provides you, as in these?

T: Ah, okay, okay. I really, I think that's a tough question to answer on the one go, because it also, I think this would be very helpful on the second time, because when I understand the thing, so maybe my conclusion from this would be to create an instruction run before the real one, so someone actually understands what he has to go through and what is important to remember. So let's say, is it your first time voting? Okay, let me guide you through, for example. But if someone is doing the second program, sometime, I think it should be quite easy, and this is, yeah, this might be helpful if you know what to look for.

I: Do you think like a video, maybe?

T: Maybe like a video, or yeah, it could be a video actually.

I: Okay. What do you think about the re-voting mechanism overall?

T: I think this is very, this depends on human memory, which can be very tricky at the verification, like from understood, there are three days on which you can vote. So maybe given the time, it's okay, but let's say someone forgets, like doing this in a rush, how do you allow people who actually forgot, or maybe someone has like damage or whatever, like there are plenty of issues that can appear. How do you ensure that they can do it again, even though they're not, they're being the true, having the true identity?

I: That's actually explored in here.

T: Okay, let's see.

I: So if you read this, do you think it provides you enough info about that?

T: Okay, yeah, yeah, okay, sure. Okay, cool. Yeah, then I think that's an interesting idea, and if you explain it well before, it should be nice.

I: Are you aware of the possibility to cast an invalid ballot?

T: Yes, yes I am aware.

I: Do you think the website provides enough information about invalid ballots?

T: Yeah, it's quite, the description is quite extensive, so yeah, I think it looks like if I wanted to know, I would find it, so it's good.

I: And how sure are you that you've cast a valid ballot?

T: As you can see, I surrendered, so yeah, but there was again, I think, an issue of trying to, but I didn't really understand at the beginning that this can be done and how it works, but maybe that's because I rushed. Well, but I think like a lot of people are like, they have no, the expectation is log in, vote, and that's it, so they kind of rush through it, and the thing is, but they also, I don't think they would even need to vote if they don't really consider that, so like the complication is the thing that they would kind of ignore altogether, so that's, you know, how do you deal with that?

I: Okay

Transcript 14

I: Alright, you have to log in and change your vote. Wait, wait, wait, wait, wait. Uh-huh. I need to actually load your user. I was test one, six. Number six, yes. Perfect.

T: Okay, so I must admit now that the guy got is not well suited, right? Okay. I mean, I remember using this, remember me and whatever. Okay. So this is identify previous ballot. How do I identify my ballot? Why is it necessary? Okay. I forgot this. To protect your privacy, does it not explicitly tell you which ballots are yours or which ones are valid? So you don't need to recognize your own ballots. Does it mean that there are fake ballots as well? Interesting. The date and time when you catch your vote, the unique visual pattern identicon and the word phrase generated on your ballot. Okay. Do I need all of them? Okay, they are. Okay, what if it's not here? I guess there is another page, yeah?

I: Yeah, it's one for pages.

T: Okay, filter by time, search phrases. Okay. I think it was something to do with spring, later spring. I remember it was on an arrow going down. Let's just look for it. Yeah. Later spring, yeah. Perfect. What if I get it wrong? If I don't remember. I can always go.

I: If you couldn't identify your previous valid ballots, your new ballot would not be counted.

T: Okay, so if for example I'm coerced or someone's forcing me to vote, I can just do it on purpose, nice? Okay, perfect. I think I voted the Social Democrats. Let's go for the Green Party. Yeah, Christiane, Green Party. Next. Legislation of Fentanyl.

Oh, yeah, I remember this. I don't want this. Okay, I'll vote for this asshole. I think I'll vote for this asshole. Another one to... Okay, century kangaroo. Okay, it's a kangaroo on the cross. Yeah, perfect. Nice. I think I may want to change the party though, because we were just voting on the president or also the party? Oh, okay. May I do it again?

I: You may do it again.

T: Okay, because maybe I just want to change the party, not the... Yeah, I put it before. Oh, nice. Are they auto-generated, the fake ones, at the moment? Yeah, it'll be important. You could identify... Okay, should I try this actually? Oh, can I select more than one?

I: Yeah, select all your ballots.

T: All the previous ones?

I: Yeah.

T: All of them? Oh, shit. Okay, this one as well. I think that's kind of annoying. I selected two? Yeah, I selected. Perfect. What if I fail to count the ballots? Do I have to go to the... Limit love. It's like a cup. Okay, one small...

I: I can answer some questions later on.

T: If you're going to re-vote later, you need to identify this ballot. Okay, so I will have to identify all three of them. Okay, fair enough. May I try messing up when voting, maybe? Most importantly... I mean, notify that this is wrong? Okay, and now the question is, does it actually count? So if I try to vote again, should I just count the folks on it as well? So identify four ballots, although my vote was not valid?

I: No, this one did not count, and you should not select this one when you vote again.

T: Yeah, I think that should be specified in case a person does it... Like a reminder if your vote is not valid, the ballot is not valid either. Because I would be confused if I had to remember this one as well. Or I would just directly go to the office to vote. Yeah, I mean, if you find yourself in a situation where you vote like five times... Yeah, it's kind of annoying. I mean, this is kind of explained, like you have to select... Yeah, yeah, identify all the ballots. Yeah, I think identify all the ballots can be kind of hustle. The thing is, actually, this doesn't say it. Because in here, it tells you actually... It tells you that you need to... Your valid ballots. It doesn't tell you which one are valid. So what's the freaking great text? You can't select previous valid ballots. Yeah, only the valid ones, okay. But yeah, it's here, but it's not here. And it should be.

I: Good point. And yeah, also... Wait, did you say something like it should tell you something?

T: Yeah, it was more regarding that. Because I think it's kind of hustle, like you have to go also for spring. They seem... It's important. They are generated on the spot, right? So I mean, because these are the last two I got. Last three. And it's

kind of suspicious. So if someone wanted to force me to vote, and they knew about this system or they tried with different people, they would kind of see...

I: What would they see?

T: They would see that the last three ballots that I got, for example, or the last two ballots that I got, are the ones appearing here. So maybe having a mix, because this...

I: Yeah, but they're sorted by time.

T: Yeah, but I mean, when I voted, the second... So the first time today, I got the secondary category. And when I voted the second time, it was the limit low.

I: Yeah, because they stored it by time. So every time they are... Sorry, every time they are generated a new one or a few minutes or... I think, at least in my code, it's like... Which one are we? Six. Six. So every time you press this, it generates... Yes, now I added a new one, actually. I think.

T: Okay. Yeah. Okay, I see, I see. Then it's fine. So it like procedurally generates fake ballots. Yeah, yeah, I mean, I would just, maybe for future work, change the code so that the ballots are... Like, the position, I guess it's an array or a list, you shuffle them. Just for security reasons, I would say, but that's the only thing.

I: Okay. What do you think about security?

T: Just shuffling them, because I wouldn't feel comfortable knowing that, for example, I know these are the two ballots that I got. And maybe, like, I don't know.

I: The thing is, even if you just voted, like, if the guy logs in and sees, like, ah, this is your vote, it doesn't tell him anything.

T: Yeah, but usually I wouldn't do that. Usually what would happen, I feel, is like, I cast a ballot, and he would see, like, because this is chronological and it's every time I put my ID, right? Okay, so I enter my ID, I generate a new ballot, and then the person can... They can kind of know how it works. I don't know if I'm explaining myself. Again, so... I said that I wrote down, like, you say that your code right now, like, it's just for code... It's just practice. Yeah, so, I mean, I would say that... It would all update in the real scenario. Yeah, like, if I were to... May I log out?

I: Yeah, sure.

T: Okay. If I return to the front page, this is the...

I: Yeah, this would not be here at all.

T: Yeah, yeah. The ballots would kind of update automatically. Yeah, yeah, that's why... Okay, that's fine. I mean, it's just so nothing happens. Yeah, there's also, like, one time I think I saw, like, slavery something. Oh, yeah, delete some possibilities.

I: Oh, it's from the Bitcoin words, I think. Ah. Word list.

T: Abuse. No! Yeah, I think that's the only... I would say it's those, like... Yeah, but then, like, they're not that many words in the English language. Yeah, yeah, yeah.

Transcript 15

T: So you need to remember who I voted for before?

I: Well, the system doesn't give you information of what you actually voted for. You need to identify your ballot based on the date and time.

T: Based on the date and time? I don't remember that. This is from today. Is it going back? So it's going to be from 20th?

I: Yes.

T: But I don't know. I probably just... Oh, I don't know. I don't really understand this. What do you mean, select all ballots that match your previous votes? How could I know? Okay. If you... Yeah, exactly. Okay. I guess I should have paid more attention to this.

I: Do you think it's the UI's fault?

T: No, it's not. It's just that if I just vote, I do not really care for the exact time. I will remember the day, but I will not remember the hour. Especially if I was not aware that I should write it down. If I would know that, then, yeah, easier, but still some people might just forget. And then they are kind of screwed.

I: Yeah, that's true. If you want to maybe look around to see what you can do in this scenario.

T: Right now I can only finish and log out, as I can see. Right. Right. I guess I can again try. Oh, I can... This is like past results. I cannot just see my vote. But this is my vote, as I understand. So now I can be sure that it's changed. Is this a resolution? Can I then just try again?

I: Try it again?

T: It's because you need to select all ballots that match your previous votes. But maybe this is... Is this auto-generated every time you... No, this one is yours that you just cast, right? And let's see if it has the same...

I: Yeah, these are not... They are persistent. They're tied to your quote-unquote account.

T: Yeah, so that means that... Well, not really, because it's not repeated here.

I: What do you mean? This? Is it?

T: Yeah, it's the same ones. Shortcut? I actually have a note on my phone. I have here... And there wasn't any code sent again. No, they don't repeat.

I: Yeah, so... The chance is really low.

T: But as in... I have a note on my phone to see what your previous vote was, and I can see it there. What was it? Just out of curiosity. It was Chef or Jiggo. Chef or Jiggo. It's actually right next to the one you clicked. So I think it was correct.

I: No, you didn't. You chose shortcut, I think, or open kidney, one of the blue ones.

T: No, no, totally not, because I knew that it was at 2 p.m. and not 3. Because at 3 I was at the air camp. Yeah, I don't think it's just a correct vote. So this is working. I don't know what can be changed here. If this is the procedure that needs to be followed, then I guess it just must be... Well, people... Oh, yeah, I chose this one. So I didn't choose the correct one. But if this is an actual procedure that needs to be followed, then I guess people will know. And then they will just need to pay attention to that.

I: You want to proceed to the questions?

T: Yes.

I: So did you feel like you knew what you were supposed to do at all points of the process?

T: Well, I knew that. I couldn't really execute it.

I: Yeah, of course. Did re-voting feel like a natural option that one may use, or like something unusual?

T: I think it's a good idea to vote, I think. But I don't know if I would care enough to do it, because most of the time when I vote, it's just like... It doesn't really matter that much because some of the options are shit. But that's the difference of person.

I: Do you think the application did a good job of explaining things to you?

T: Yeah.

I: Okay. But let me just ask, do you think the application did a good job of telling you that you should remember your vote?

T: Yes, but I didn't pay attention to that at first. Now I just knew that it might be needed, that I just looked for it.

I: I'm going to have a bunch of questions, like was it easy for you to remember your previous ballot? If yes, what helped you to remember it? If not, what would have helped you to remember it? But you said you didn't even try to remember it.

T: Yeah, if I know that, I would just write it down. Yeah, of course. I don't think there is anything that could help me.

I: I think what I did with Daniel, he got lucky with the picture because it was like an arrow pointing down. So then it was really easy for him to recall it, but it's just...

T: I didn't even pay attention to the picture. But I guess if I could choose my own, that doesn't make sense.

I: No, it needs to be deterministic. It needs to be anonymous. Are you aware of the possibility to cast an invalid ballot?

T: Well, yes.

I: Do you think the website provides enough information about invalid ballots?

T: That it will not count as a vote, yeah.

I: And how sure are you that you have cast a valid ballot?

T: I don't know. How can I be sure ever, actually? Not unless I had this written down.

I: Actually, the website provides kind of information what you can do in this scenario. If you want to look for it. It's actually in the help section.

T: I cannot vote in person. But I already voted online. Right. So how does it work? Do they then...

I: I guess I was kind of hoping that the description is good enough that you would know.

T: No, because I voted digitally and they cannot show me which ballots are mine. And I also shouldn't even know which ballots are mine, exactly. That's how it is supposed to be anonymous. Does that make sense? So then... Then would it mean if I voted digitally and then I go physically, will my digital vote be just revoked? Okay, that makes sense. But then I guess I cannot re-vote again.

I: No, you can't re-vote in physical elections anyway. Do you think these were good descriptions? Does it make sense?

T: I would add, actually, I would add here the section, like the explanation that if I vote physically after voting digitally, my digital votes will be automatically deleted. That is like 100

I: Yeah, that makes sense. Right. There's also kind of a third scenario where I would go kind of, I would pretend to be the coerced and have you try one of the security measures. But yeah, you want to try that? Okay. So, yeah, basically imagine I'm sitting next to you, like I am right now, and I'm telling you that you need to log in and vote for the first option on every single question and kind of want you to try to use one of the security measures to make sure that it's your final vote that counts.

T: I still need to know what I'd do. Yeah, re-voting makes sense.

I: But also maybe just kind of if I'm already there coercing you, I wouldn't really like you reading this. If I'm already there coercing you, like I'm some bad guy, I wouldn't like to see you reading this.

T: Yeah, of course. But then I guess I would just need to do all of that stuff and then I would be thinking about what can I do now after you're gone. But maybe that doesn't really make sense to go through right now. No, I guess not. Okay, so this is kind of unclear because it just says that I have options. But what options? Right. I guess I need to go to help.

I: Yeah, yeah. Maybe that's an issue I need to, like if I'm going to bring it up, I should just expand on it anyway. Yeah, that makes sense.

T: Okay, so now we can vote again.

I: Sure.

T: So I can just say that I already have voted, but I can re-vote if you really want to. So I will choose this and I will say that I have voted yesterday at about 1 p.m.

and it would be this one. And I will vote for whatever you want. Which one?

I: Just the first one.

T: First one, okay. And then it's invalid.

I: Yeah, just the quick question is kind of would you feel confident using this to...

T: Okay, so if you asked me to lie, a lot of people are very bad at lying. Yeah, that's true. So if somebody is very bad at lying, then they should just go for re-voting after this. But again, this will require you to know that you can re-vote, but I guess you should know that.

I: Yeah, I guess.

T: So there are two options, one for good liars and one for bad liars.

I: Yeah, it all hinges kind of information being presented and the way it is presented. So then, yeah, I guess the main task of the thesis is kind of designing it in a way where it gives you the most information in the best way. And yeah, actually, in the test that I've done, there's like a bunch that I've been told to change. It shouldn't be in red because it's kind of alarming to some people, I guess. And then maybe put this and have it being like blue and maybe bolded text. Like if you plan to re-vote later, it should be very highlighted.

T: Yeah, yeah, this could be bigger. Just a bigger font, maybe.

I: I guess, yeah, maybe I'll have a section in the thesis like kind of changes proposed after the testing. And yeah, I guess that's it for us for today. Thanks. Cool.

Transcript 16

I: Oh, there you go. So, yeah, your task is to log in and vote, and kind of maybe think out loud about what you're doing. And just for the record, I'm going to record your activity and the audio, but for the thesis, I'm only going to quote you anonymously. Is that okay?

T: That's fine.

I: Cool.

T: Okay, so I'm clicking on the yellow button that says I can vote. Oh, I did that again. I see. There we go. Okay. I should choose incognito. Why is this important?

I: Okay. Just for this specific test, I need to save a cookie for you so I don't actually use incognito.

T: So I just press here?

I: Yeah.

T: I'll press to log in. Continue, because we don't log in with MitID. Okay, there we go. Enter. I'll wait and start voting. No, this is my first vote. Okay. I want to change. I want to vote for change. I like that. No, it shouldn't. Next. Just vote for

the new person. I like Nancy. There we go. Okay, I press submit vote. Okay. Date and time. This is time. This is date. Okay, I guess that's it. So I just press here, finish, and log out.

I: Yeah, and we're going to do the voting simulation tomorrow.

T: Yes, okay. Cool. There we go. I'll just take a moment. I'm successfully logged out. Returning to front page. Okay, there we go. Do you want me to stop the timer?

I: No.

T: Okay.

I: It's not a timer either. It's a recorder. Yeah, so, I mean, was everything clear?

T: Everything... Yeah, I mean, the only thing was that I shouldn't go into inognito, but that's for the test. Yeah, yeah, yeah. So that makes sense.

I: There's nothing I can do about that.

T: No, exactly. But, yeah, I think...

I: I mean, full disclosure, you've seen this part before, right?

T: Yeah.

I: So I think we'll get most of the things that I actually want to ask tomorrow when you do the revoting because you haven't seen that.

T: Mm-hmm.

I: And, yeah, so anything you want to add or, like, anything that surprised you, anything you need to explain?

T: No, I don't think so.

I: Okay, cool.

T: I don't think there's anything I needed to explain either.

I: Right, so... Maybe tomorrow when we have the re-voting, there will be more.

T: Yeah, I think that will be much better.

Transcript 17

T: Okay, so all I need to do is just go in and change my vote. Okay, I'll log in. So I can go into my... I'm not gonna go into incognito. I'm gonna go into MitID. Gonna press continue. Hello? Oh, there we go. So... Now I need to see... I still need to enter this election, I guess. But now it will ask me if I have not voted or if I have voted. I have voted before. There we go. Now I need to find my vote. It's not today. It was just... Oh, there's so many people who voted, what the fuck. It's not in SDs. This one. Continue voting. Incorrect? What? No, I'm sure this is mine. Yes. Nice! Okay, now I can... I will vote for something else. I'm gonna find Green Party. No, I still don't agree with that. There you go. And I'm gonna change who

I voted for. I'm gonna say yes, submit the vote. Now I got a new one I need to remember. Now it's green instead of blue. Okay, finish and log out. Okay, done. Return to front page.

I: Do you feel like you knew what you were supposed to do at all points of the process?

T: Yes.

I: Did revoting feel like a natural option that anyone could use? Or like something unusual for, I don't know, some very specific people?

T: It seems very natural the way that it's been put up, but not natural the way that I'm not used to being able to do that.

I: That makes sense. Was there every moment where you felt you needed something explained to you?

T: I was worried that it wasn't my... my... what's it called? Ballot? Or my vote? But of course it popped up to be like, are you sure? Because it makes sense that you're not sure. Like, you should be 100

I: Was there anything unexpected during the experience?

T: No.

I: Was it easy for you to remember your previous ballot?

T: I think so, yeah. I hope I did it correctly.

I: What helped you most to remember it?

T: The dessert.

I: Okay. So the keyword.

T: Yes. And also the drawing. I remember it was blue.

I: Ah, great. What do you think about the current memory aids overall?

T: Huh?

I: What do you think about the current memory aids overall, that being the keyword and the drawing?

T: I think it's fine.

I: Cool. What do you think about the rewording mechanism overall?

T: I think it's good.

I: Okay. Are you aware of the possibility to cast an invalid ballot?

T: Yes, I am.

I: Do you think the website provides enough information about it?

T: I think so, yeah. With the pop-up as well.

I: How sure are you that you have cast a valid ballot?

T: Pretty sure. Like 95? But it's just because I'm unsure if I remember correctly.

I: Yeah, you did actually.

T: Nice.

I: You want to do the third scenario as well?

T: Yeah, sure.

I: It's a hypothetical scenario. You have to imagine that I'm a coercer and I'm trying to coerce you to vote. So I'm here physically watching over your shoulder telling you to do something. So now the critical part is you can't really be obvious. You can't click on any help things or do anything about coercion because that obviously took me off. And I'm telling you that you need to vote for the first option in every category. But your goal is to make sure that at the end when we are done with this, it's your actual vote that counts and you can employ any strategy you think you can.

T: Okay, so should I just start?

I: Yeah, go for it.

T: Okay, I'm logging in. Oh. Logging in. I'm logging in with my ID again. Continue. I'm going to see into this election. No, this is my first vote. And you want me to vote for all the first ones in this category? Submit my vote. There you go.

I: Cool. Could you describe in your own words what you think you did to achieve your goal?

T: I know I already voted before. So saying that, oh, this is my first time voting again, I will think that the system would recognize, no, you actually have voted before. So the first vote should be the one that counts. Or let's say that I'm now alone and I can go in and re-vote. I can also still do that, but I still right now think my first vote that I also just changed is the valid one.

I: Okay, cool. Did you feel confident that the system wouldn't reveal anything about you if you clicked incorrectly?

T: Yes, I'm pretty sure. Like, the only thing it would do, even if I went in, is like, let's say that I pressed the wrong... No, yes, I voted before. Even here, you can't see that I am one of these votes. So yes.

I: Okay. Cool. Thanks.

Transcript 18

I: And do you feel like you knew what you were supposed to do at all points of the process?

T: For example, the one that I wanted to find my ballot, I couldn't because I don't know, maybe I didn't pay much attention. I just followed the next or continue or something. I think if there is an option to say, you cannot continue until you find

your ballot to change it because I pressed that button that this is not my first time. So I shouldn't get to the next before I find my correct ballot.

I: Yeah, but it's actually a deliberate choice because there's the security and usability trade-off. And it's really unfortunate that my laptop died here because there was actually a third scenario that we could have done together.

T: Okay.

I: And it's when somebody's, the thing that's trying to prevent is when somebody's behind you and they're telling you how to vote. And at that point, the application is designed so it doesn't reveal anything about you to anybody.

T: And it's so that like, yeah, even if you don't select anything, it's true. Like there's no point where it can kind of damage you.

I: Do you think the application did a good job of explaining things to you?

T: Yeah, but there are, as I said, there are a lot of description there. So I don't know really to pay attention to which of them. So I just briefly look at that and I try to go through the process.

I: So like complicated?

T: Yeah, sometimes. Because when I want to vote, I want to see what I want to select and then done. Not just read this, read this, or maybe you could have in more pages but less explanation. Maybe.

I: Yeah, that makes sense.

T: Because I am the lazy user. I just want to pick the one that I want from that page and go through it.

I: Yeah, that makes sense. Was it easy to recognize your previous ballot or to find it?

T: Yeah, it took a while, but still, because I had the exact time and date.

I: And what do you think about the two memory aids that the system provides you with, the picture and the text? Do you think they're helpful?

T: Yeah.

I: Okay. Are you aware of the possibility to cast an invalid ballot?

T: How? Can you? What exactly should I answer to this question?

I: Oh, it's mostly the question is to see if the system did a good job of informing you about these things.

T: Okay. Yeah. As I said, because I thought, okay, there aren't many ballots, so I tried to just scroll between pages. But sometimes if the position of that filter could help more, maybe, at the sides, so I see that, okay, this is easier to use.

I: Got it. Do you think the website provides enough information about invalid ballots?

T: In the case that you mentioned, if somebody's forcing someone to vote, so now I see why we shouldn't say that it is valid or it is not in the case that we want to change our vote. So afterward, we know. So that one is not valid anymore because I want to change it. So that was okay.

I: Okay. And how sure are you that you have cast a valid ballot?

T: Some questions are challenging to answer, but more or less, I think that was okay.

I: Okay.

T: Yeah.

I: So you're sure that your ballot was valid?

T: Yeah, based on the date, because we didn't have any other options. Yeah. But also when I opened that one, I couldn't see my vote, my previous one. If I could see, like, opening that ballot, it would be easier, maybe, because now we have just date and time.

I: Yeah.

T: So maybe a couple of people just voting at that time, if there is a case like this, then it will be difficult to understand. It's exactly mine or somebody else's. But if I open it and see what I voted, so maybe it helps more.

I: Yeah, it's just something that's come up multiple times. Like, it's not other people's votes.

T: Yeah, I mean, for example, I claim that this is my ballot, but that wasn't. So I tried to open the other people's.

I: Yeah, but once again, it's not other people's votes. It's fake votes.

T: Okay.

I: So everybody has, like, kind of a list of just theirs, and you have your fake votes and your real votes.

T: Okay. Now it makes sense.

I: So it is in the wording. And do you think, since there wasn't any confusion at all, do you think I need to explain it better? Do you think there needs to be, like, because then I have to put in more disclaimers?

T: Yeah, if the rest are fake, maybe you could just have it in one page. But is there a reason to just scroll between a lot of pages, a lot of ballots?

I: Yeah, it's just, it needs to generate, I think, one every 10 minutes. So it goes up to 1,000, I think.

T: Ah, okay.

I: Yeah, and that's the guy who designed the system. It's on purpose.