VOX Research Report

SUMMATIVE EVALUATION

MAY 2015

IDEO + LA COUNTY


KEEP CALM AND DANCE
KEEP CALM AND DANCE

Summary

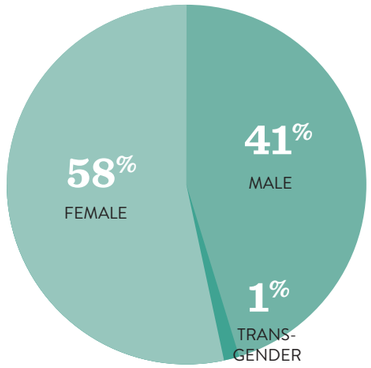
This research session tested the polling place experience, providing the IDEO team with qualitative and quantitative data to inform the final design of the ballot marking device (BMD). During previous research sessions, we learned how to develop the user interfaces for touch and audio voting, the interactive sample ballot, the BMD hardware, and the voting booth. This summative evaluation tested the accessibility, usability, privacy, and trust of this new system, providing the final round of feedback from diverse participants in Los Angeles. This comprehensive round involved five user research sessions across the county. It was a deeply collaborative effort with leadership and operational support from the IDEO and LAC RR/CC teams. The analysis of quantitative and qualitative data provided insights, both validating existing system design and identifying remaining opportunities for improvement.

Participants

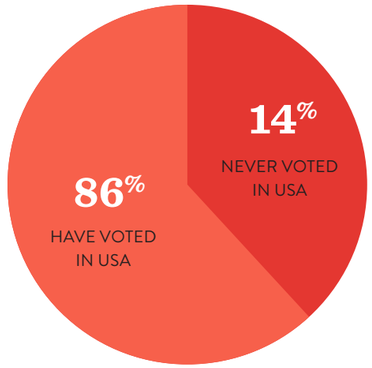
IDEO and LAC RR/CC worked in partnership with community-based organizations and governmental departments to recruit diverse participants from across LA County. Partnering organizations included the Korean Community Center, the League of Women Voters, the National Association of Latino Elected and Appointed Officials (NALEO), the Department of Community Senior Services, and the Department of Military and Veterans Affairs. A total of 167 people participated in 5 sessions, as detailed in the table below. Participants were recruited purposefully, meaning that the IDEO team selected participants according to traits that might most inform system design decisions. Additionally, a sub-sample of participants were selected to test out a novel way of voting via an "Interactive Sample Ballot" (ISB), which allows voters to pre-populate selections prior to going to the voting booth and then use the BMD's scanner capability to quickly mark and cast the ballot at the polling place. Findings and recommendations from the ISB voting experience are presented in a separate section.

SESSION	SELECTION CHARACTERISTICS	PARTICIPANTS	ADD. ISB USERS
Session 1	Seniors & people with minimal tech experience	**27**	4
Session 2	Veterans & people with motor disabilities	**36**	3
Session 3	Spanish-speakers, people with visual impairments	**37**	**3**
Session 4	Korean-speakers & college students	**32**	**1**
Session 5	LAC RR/CC extended community	**35**	**3**

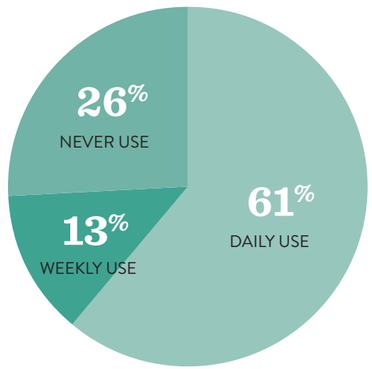
GENDER



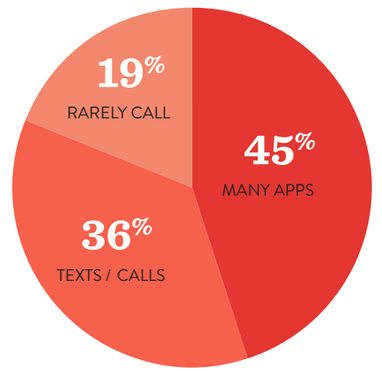
VOTING EXPERIENCE



COMPUTER USAGE



MOBILE PHONE USAGE



RACE / ETHNICITY

Latino / Caribbean	37%
White / Caucasian	27%
Other	24%
Asian / Pacific Islander	20%
Black / African-American	17%

Results add up to greater than 100% as several participants reported mixed racial/ethnicity.

ACCESS CHALLENGE

Visual	13%
Motor	12%
Cognitive	8%
Other	7%

AGE

18-29	14%
30-39	14%
40-49	11%
50-59	12%
60-69	21%
70-79	21%
80-89	5%

FINANCIAL SITUATION

Not enough for basics like food	2%
Not enough for bills	2%
Living month-to-month	22%
Enough but need to save more	29%
Comfortable with a little left over to save	33%
Very comfortable & splurge	12%

EDUCATIONAL ATTAINMENT

No formal schooling	0%
1-8 Grade	9%
9-12 Grade	6%
High school	7%
Associates or Bachelors	35%
Masters	16%
PhD or professional	8%

Participant Breakdown

Participants were diverse in terms of race/ethnicity, gender, age, educational attainment, ability, voting experience, technology experience, and financial status.

Methods

This summative evaluation assessed the polling place experience using quantitative and qualitative methods. Upon arriving into the research experience, participants were immersed in a simulated version of the 2018 election. This election involved a prototype set-up of a vote center, open to voters from any precinct. The voting process involved several distinct steps designed to simulate a real voting experience using the Ballot Marking Device (BMD). Voters were first provided with an official ballot, which was printed with a ballot activating mechanism in the form of a QR code (printed on the upper left corner ballot). Voters were then given a vote list and instructed to approach any available booth and complete a voting session using this vote list.

Participants used the vote list method to make selections. This method, supported by the state voting system certification board, entails supplying the voters with a common list of choices for candidates and propositions and asking them to select only these choices.

The voting process also involved casting votes into an integrated ballot box after printing their completed ballot. Voters were told they could request assistance from available poll workers at any time.

A data collection instrument was developed by the IDEO team to collect quantitative and qualitative metrics to capture data on usability, accessibility, privacy, and trust. Trained IDEO and LAC CC/RR staff collected this data via structured observation (during the voting process) and individual interview (post voting experience). Qualtrics analytic software operating on iPad devices was used to collect all data. This instrument probed users on challenging stages of the experience and asked a series of demographic questions. Interviews were conducted in Spanish, English, or Korean, depending on the preference of participants. For a list of all questions and answer choices within these instruments, please see Appendix at end of document.

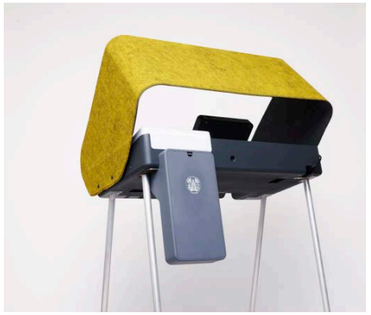
Quantitative data was analyzed using descriptive statistics on Qualtrics analytics software and Microsoft Excel software. Qualitative data was analyzed using modified grounded theory methods through Qualtrics analytics software.

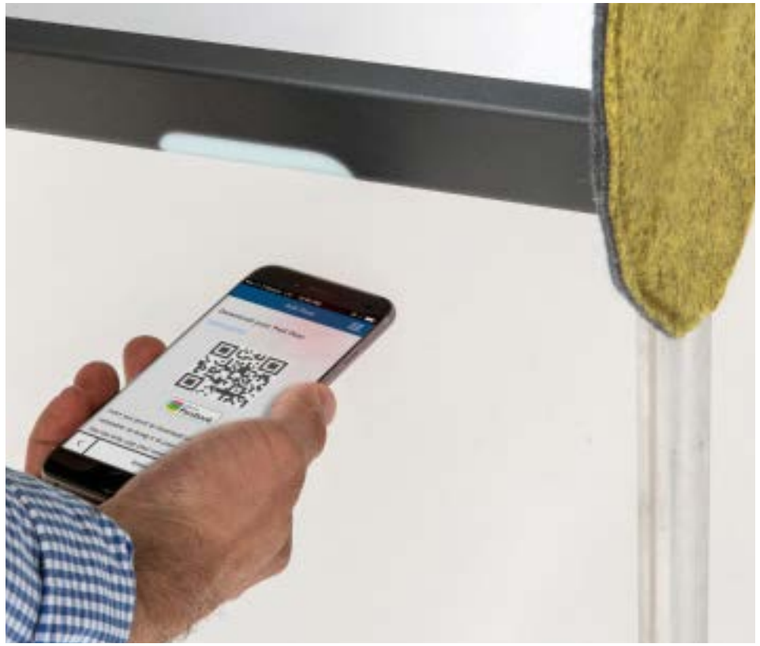
Overall limitations and biases for the study include a Hawthorne effect[1], social desirability bias[2], and sampling bias[3]. These limitations are addressed by unobtrusive observation protocols, encouraging critical feedback, and recruiting participants from diverse race/ethnic, linguistic, ability, and socioeconomic backgrounds. Moreover, these research sessions are among dozens of iterative cycles of research, all contributing to an overall understanding of user behavior and preferences.

1. People tend to act differently when they know that they are being watched.
2. People tend toward social acceptable behavior and statements in a new social environment, often avoiding giving negative critique.
3. This is not a random or strictly representative sample of individuals, so their experience and feedback might not be representative of others'.

Prototypes

Three integrated hardware/software prototypes, depicted on the following page, were fabricated. These prototypes created a simulated experience that would allow voters to behave like they would in a real polling place. The means by which the experience was created, technically, differ from the production hardware and software that will ultimately be used for real elections. For example, the printer for the prototype was not fully operational, so the IDEO team simulated the experience by having a pre-printed ballot emerge from the printer slot.





"I am a veteran of two wars and this is the first time the government has ever asked my opinion on something."

Accessibility Insights & Findings

TOPIC: Accessibility

BIG QUESTION: How might we design an accessible polling place experience?

WHAT WE'VE LEARNED: 99% of all tasks completed by all voters were accessible.

DESIGN DECISION: These learnings validate system design decisions. In terms of remaining decisions, there is still a need to refine the multi-select and scrolling functionality.

PRINCIPLES: Private & independent

BACKGROUND

One of the fundamental principles of this new generation of voting systems is enhancing access for people traditionally marginalized by voting systems. Currently many voters rely on others to assist them in voting or using the audio ballot booth, a tool optimized for people with visual impairments. Early in Phase 3 of the IDEO project, we developed design principles to guide this process: one of them is to **design for convergence**. This principle encourages designers to look for features that meets the needs of multiple communities within one BMD.

Curb ramps are often sighted as an example of civic design that meets the needs of multiple communities without worsening the experience of other communities, and are analogous to the types of convergent solutions we seek for the BMD. Curb ramps make sidewalks accessible to people in wheelchairs, make walking easier for families with strollers or people with walkers, and provide quick conveyance for delivery dollies for everyone from postal workers to retailers.

People with a diverse range of abilities and disabilities participated in all five research sessions. Overall, 40% of participants reported living with one or more disabilities. This included 13% visual, 12% motor, and 8% cognitive disabilities, among many others. The prevalence of disability was much higher among our participant population than the Los Angeles County population as a whole. According to the U.S. Department of Human Services, 20% of adults in Los Angeles County reported some kind of disability. Yet, those who participated were people who were able to make it to a polling place, perhaps excluding the most severe mobility challenges. None of the participants, for example, required a sip-and-puff or A/B-switch peripheral. Early research with people living with Cerebral Palsy provided our team with some understanding of how to design an accessible voting system for this community. We also recognized that this study focused on the BMD voting experience as some voters with access challenges have traditionally opted for vote by mail.

As the experience of disability was different for each participant, design solutions were required to meet an array of needs. For one senior, this meant the need to put aside his cane and endure arthritis while voting. For a homeless voter living with the complications of diabetes, this meant finding the right interaction approach to voting given his limited hearing, severely limited vision, and major loss of sensation in his fingertips. For a recent veteran struggling with post traumatic stress disorder, this meant finding a fast and simple way of focusing his attention despite his anxiety about the crowd of people around him.

MEASURING ACCESSIBILITY

During the research sessions, poll-workers observed voters and rated each task. Tasks were rated on a 1-4 likert type scale that extended from accessibility to usability; 1=impossible, 2=hard 3=ok and 4=easy. Tasks were deemed "impossible" if they seemed physically impossible for a particular participant to complete, for example a task required a person in a wheelchair to reach higher than feasible, a blind person to touch a non-tactile button on a screen, or a person with limited fine motor skills to delicately and precisely position a ballot. Disabilities are not limited to physical impairment, however, it was difficult to determine if tasks were made impossible due to cognitive disability. Thus, the accessibility scores we determined tended to relate to what was physically observable and as such, should be interpreted accordingly. Tasks were deemed accessible if the observer did not categorize the task as "impossible" or 1 on the 1-4 scale.

FINDINGS

For the purposes of understanding each stage of the voting experience, we divided voting into several major tasks: "Starting a Session", "Making Selections", and "Casting a Ballot". Each of these tasks was further broken into 16 unique steps, relevant for that particular task. Throughout the research sessions, 132 voters completed 1321 separate voting steps. While the number of tasks presented to each user varied based on their unique voting experience (e.g., touch screen vs. immersive audio user), according to our observational data, 99% of all tasks completed by voters were accessible (not impossible to complete).

For the touch experience, all aspects of the experience were 99% or 100% accessible with the exception of making selections on multi-select contests, which scored at 96%. When interviewers asked voters about this challenge, they discovered that a small percentage of users struggled with the scrolling function. Given the size of the screen and its ability to display most contests entirely within one screen, the multi-select contests were the first moments when scrolling became necessary. Observers noted that, for some voters with low vision, the scrolling button was too visually subtle. For those with limited fine motor skills, sensitivity, or dexterity in their fingertips, the scroll button may have been too small. The verification process scored 99% for the touch experience because some voters wished to but were unable to pick up their printed ballot to read (rather than reading it in place on the output tray of the BMD).

For the audio experience, tasks were 100% accessible. The exception was the audio verification feature, which was not yet developed for this prototype.

RECOMMENDATIONS

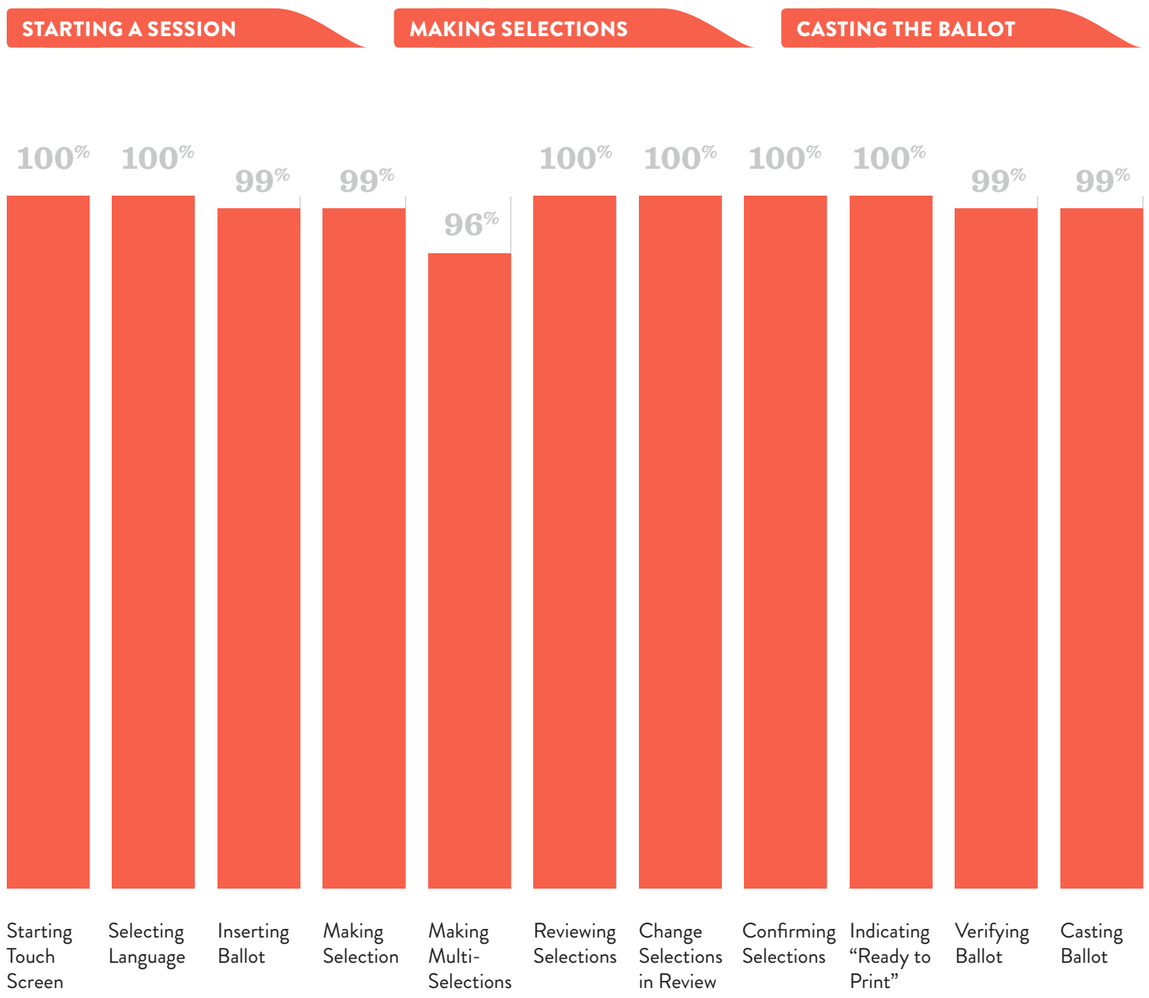
According to these findings, the overall accessibility of this new voting system is 99% across the board. After months of research and design with communities traditionally marginalized by voting systems, this percentage is the high water mark. Acknowledging this success, we must also acknowledge the further opportunities for growth during this last refinement stage.

The first opportunity to enhance the accessibility of the touch experience is improving the scrolling functionality. We recommend making the scroll button larger and clearer, with both graphic (downward arrow) and text ("more below") indications of its function.

Second, design changes can make the verification step easier for the voters who will read the printed ballot. For example, one idea is to create a small hardware indentation in the print area that allows for voters to easily grip the paper ballot from both sides and lift it for review.

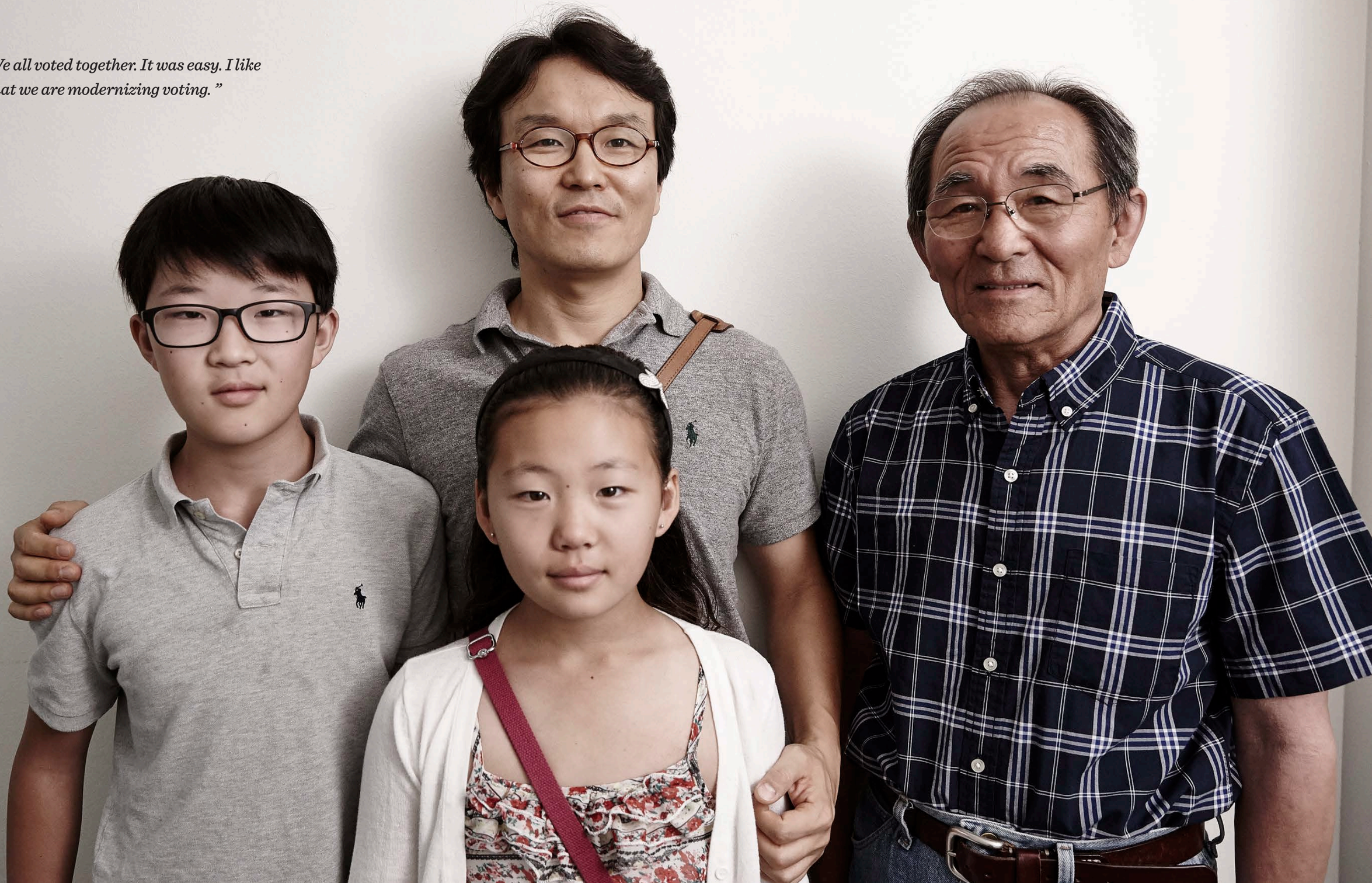
Touch Screen Experience

Accessibility during voter experience
% of Voters who found step accessible



Immersive Audio Experience

"We all voted together. It was easy. I like that we are modernizing voting. "



USABILITY INSIGHTS & FINDINGS

TOPIC: Accuracy

BIG QUESTION: How might we design a BMD that helps voters accurately mark their ballots?

WHAT WE'VE LEARNED: The overall accuracy of this system is 96% for maintaining ballot accuracy and 0.00% for residual vote rate. The Total Completion Score was 100%. The Perfect Ballot Index was 1.5 and the Voter Inclusion Index was .73.

DESIGN DECISION: These learnings validate user interface design decisions. In terms of remaining decisions, there is still a need to refine the multi-select and scrolling functionality.

PRINCIPLES: Easy

BACKGROUND

Accuracy is one of the key metrics for evaluating voting systems. Accuracy is assessed for certification and as a part of scientific usability studies, including several studies conducted by members of our advisory committees. In testing scenarios, accuracy is evaluated by asking voters to use a vote list and calculating the percentage of correct votes. In real voting scenarios, accuracy is evaluated using the residual vote rate.

During these research sessions, data to assess ballot errors and residual vote rate were collected through system analytics software on our digital prototype. Once voters cast their ballot, their final votes were uploaded to a database and analyzed using simple Excel statistical formulas. There is no agreed upon gold standard for ballot error rate and, as such, it is mostly used to understand which technologies, user interfaces, and contest types are comparatively inaccurate. To calculate the ballot accuracy rate during this study, we divided the number of voter selections that were correct according to the vote list by the total number of selections.

Residual vote is rate calculated as the percentage of ballots cast that either contain an over- or undervote for the top race, such as selections for president made during a presidential election. These are well researched and published, providing performance metrics to compare against. For instance, in their study of the residual vote rates in 2004 elections, Kimball and colleagues found 1.8% for the Votomatic punch card, 1.0% for lever machines, 1.7% for paper ballots, and 2.0% for InkaVote. These residual vote rates translate to real world results. A 2.0% residual vote rate for the 2004 InkaVote system translated into over 20,000 ballots that were mistakenly cast for every 1 million voters.

Other important performance metrics we felt were essential to evaluate for purposes of comparative accuracy were the "Total Completion Score", "Perfect Ballot Index", and "Voter Inclusion Index".

- The Total Completion Score is defined as the the proportion of users who successfully cast a ballot (whether or not the ballot contains erroneous votes). Failure to cast a ballot might involve problems such as a voter simply "giving up" during the voting session because of an inability to operate the system, or a mistaken belief that one has successfully operated the casting mechanism. According to the CVSPS, this number should exceed 98% for a voting system to be certifiably accurate.
- The Perfect Ballot Index (PBI) is based on the ratio of number of cast ballots containing no erroneous votes to the number of cast ballots containing one or more errors. According to the CVSPS, this value should aim to be above 2.0 (ie there should be over two perfect ballots for every error filled one).
- The Voter Inclusion Index (VII) is a measure that accounts for the consistency and accuracy of a given voting system by using both the mean % of correct ballot choices and the associated standard deviation. A high percentage of correct ballots and a smaller standard deviation across scores indicate that voters are participating consistently in a correct manner. According to the CVSPS, this number should be at least .35 for a system to be certifiably reliable.

FINDINGS

In this analysis, we found a ballot error rate of 4% among adherent users. Adherent users were those voters who tried to use the vote list, as confirmed by observers and our automated analytics. We found that the error rate differed between contest types, ranging from 99% accuracy among the propositions to 92% accuracy among the multi-select contests. We also found that average error rates differed, but not significantly, by language group. Those who voted in English had an accuracy rate of 96%, as compared to 97% for Spanish-speakers, and 93% for Korean-speakers. In a similarly slight and insignificant difference, those who use the touchscreen interface had an accuracy rate of 97% and those who used the audio system had an accuracy rate of 95%.

All in all, this meant that participants were highly accurate in recording their votes and there was little difference between the average voter and voters who have traditionally faced access barriers. For those voters who visibly struggled to enter their selections, interviewers asked about the challenges they encountered and their suggestions for improvement. We learned that some among this small percentage of voters did not see the multi-select candidates below the screen and did not notice the scrolling button function, which consisted of an arrow icon. The data confirmed these observations as the two candidates appearing below the fold on the two multi-select contests scored an 84% and 86% accuracy rate, respectively.

We found a residual vote rate of 0.00%. In other words, there were no overvotes and all ballots cast included a vote for the top race, Governor in this case. This unexpected and perfect residual vote rate was perhaps enabled by an electronic system that did not allow overvotes and a total number of adherent participants (n=104) that was relatively small compared to a real election. When both first and second contests are included in the residual vote rate, in this case Governor and Lieutenant

Governor, the residual vote rate was 0.48%. Keeping study limitations in mind, the residual vote rate is nonetheless excellent and provides some confidence in the user interface and its approach to contest selection. Comparing several voting systems to the VOX residual rate and translating that into predicted under or over votes per 1,000,000 voters yields impressive improvements in voting accuracy. Compared to other Electronic Voting machines, VOX could potentially improve under or over voting errors by over 20,000 votes per 1 million voters.

For our additional accuracy metrics, the Total Completion Score across all adherent users was calculated at 100% (104 out of 104 ballots completed). Our Perfect Ballot Index fell short of the recommended benchmark with an index calculated at 1.5 (62 perfect ballots out of 104), however, as described above the majority of errors appear to be concentrated around the multi-select candidate options (see recommendations). Our Voter Inclusion Index was high (.73) due to both generally high accuracy (96%) and a small standard deviation around this mean (5%).

RECOMMENDATIONS

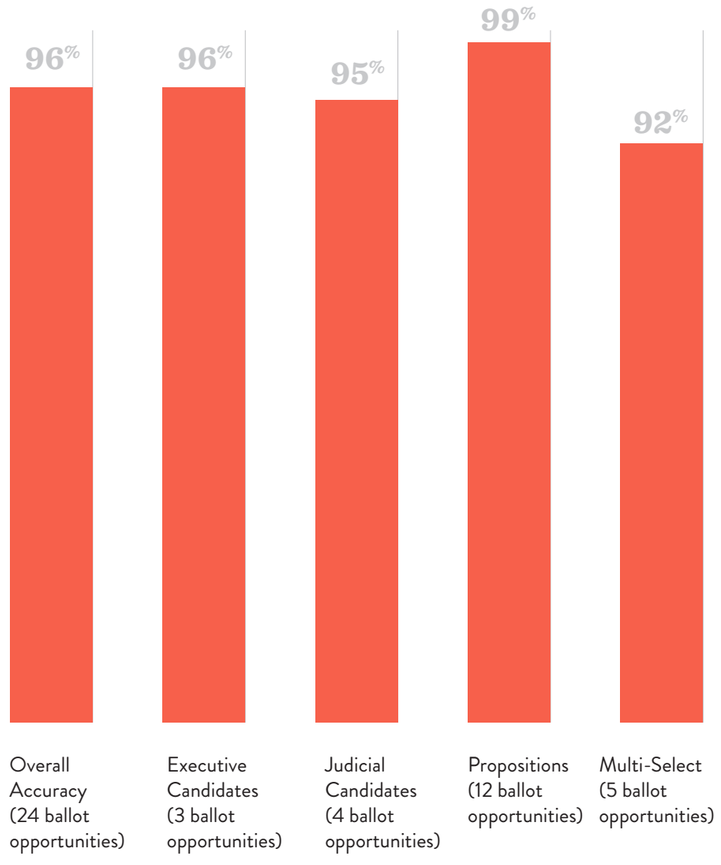
According to these findings, the overall accuracy of this system is quite high -- 96% for maintaining ballot accuracy and 0.00% for residual vote rate. Given the diversity of our participant population, this rate is resoundingly positive. At the same time, our findings present a few final opportunities for design refinement.

As described in the accessibility section, we recommend refining the user interface in the following ways:

1. Add additional text to the scroll icon: add “See More” along with a bigger arrow visual enhancing the discoverability of more content below the line of sight.
2. Further, the user interface should include visual indications that more information is below by always including the top half of the first line of content “below the fold.”
3. Reallocate space on the user interface for measures, allowing the full description of measures to be included on the first page and eliminating the need to scroll down to read more.

Ballot Accuracy Across Contests

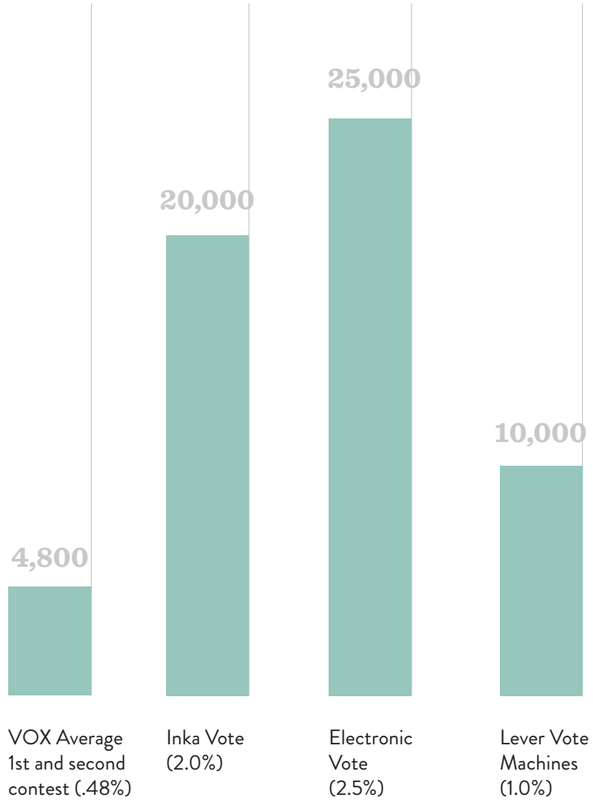
Percent of ...????



Residual Vote Rate

Comparison of predicted under or over votes based on residual vote rates (per 1 Million voters) for four voting systems

# of over or under votes in top level race (per 1 Million voters)



ACCURACY METRICS

Vox Total Completion Score	100%	CVSPS Standard Completion Score	98%
Vox Perfect Ballot Index	1.5	CVSPS Standard Perfect Ballot Index	2.0
Vox Voter Inclusion Index	0.73	CVSPS Standard Voter Inclusion Index	0.35

"It was easy. And I think this will get more young people out. It's time to make room for the next generation. But, you know, it works for me too."

USABILITY INSIGHTS & FINDINGS

TOPIC: Ease

BIG QUESTION: How might we design a voting system that is easy to use?

WHAT WE'VE LEARNED: On a scale of 1-4, the system scored from 2.8 to 3.7 in terms of ease, even among a diverse and extreme group of users.

DESIGN DECISION: Continue to refine the multi-select and print-verify-cast sequence. Provide educational opportunities and support to voters during the roll out of the new system.

PRINCIPLES: Easy

BACKGROUND

As described previously, usability of voting systems is understood as the accuracy, ease, efficiency, and satisfaction experienced by users of a voting system. The second metric for evaluation is ease. As described with accuracy, ease is one of the metrics for certification of new voting systems. Previous evaluations have consistently and iteratively assessed ease. Our findings around ease are used to inform our design decisions and continually refine our prototype, testing again and refining again in an agile manner.

Our IDEO team developed a user journey map, assessing ease through observation throughout the voters' experience. As described previously, we rated ease of each stage of the journey on a scale from 1-4: 1 was impossible, 2 was hard, 3 was ok, and 4 was easy. Thus we were able to assess the experience of users from different demographic backgrounds, understanding not just how the average user excelled or struggled, but also how users from communities with traditional access challenges excelled or struggled. This same scale was used to assess usability during previous research sessions, including our analysis of InkaVote. From these older scores, it is clear that major progress has been made since the beginning of this project and as compared to the InkaVote scores.

FINDINGS

The experiences rated very highly, in terms of ease across the different steps, from a mean score of 2.94-3.54 for the touch experience and 2.8 to 3.67 for the audio experience. For both of these experiences, the same stages tended to be rated highly: getting started, making selections, and reviewing selections. The lower points tended to be around steps involving multi-select contests and the sequence from verify to cast. The details of these scores are provided on the following page.

For a deeper understanding of these quantitative scores, we asked voters to tell us about the tasks that seemed difficult for them. As we listened to voters' descriptions of their experience, we learned that most voters' struggles were not particularly memorable or bothersome but rather a part of learning a totally new process. Many claimed to find it simple, even though observers indicated that they had some trouble. Typical comments tended to involve voters describing the way they discovered totally new features. "I thought it was a shelf for my things," said one voter, "and it wasn't until I saw what the screen said that I realized that my ballot went into that slot."

Voters, who had received no information at all about the new system, were figuring out how to use an entirely new system based on their intuition alone. Some depended on old habits, "I thought that I needed to take my ballot somewhere, as usual, so it was confusing. Then I read what it was telling me to do and put it back into the machine. It sucked it up." We found that many needed detailed instruction about what to expect after the ballot was printed. Although the screen provided instructions once the printed ballot emerged from the ballot slot, voters' attention was often distracted at this point in the process.

RECOMMENDATIONS

The ease scores were quite high, especially relative to the previous scores and InkaVote scores collected during other sessions. The team focused an immense amount of attention on making the system as intuitive as possible. However, we know that launching a new voting system will also involve educating voters about changes, giving them opportunities to learn how to use the new system and customize it for their needs, and providing strategic support to voters and elections operators during the systems' first years of use in polling places.

Although the ease scores were considerably high, we nevertheless see a few opportunities for improvement. We recommend the following.

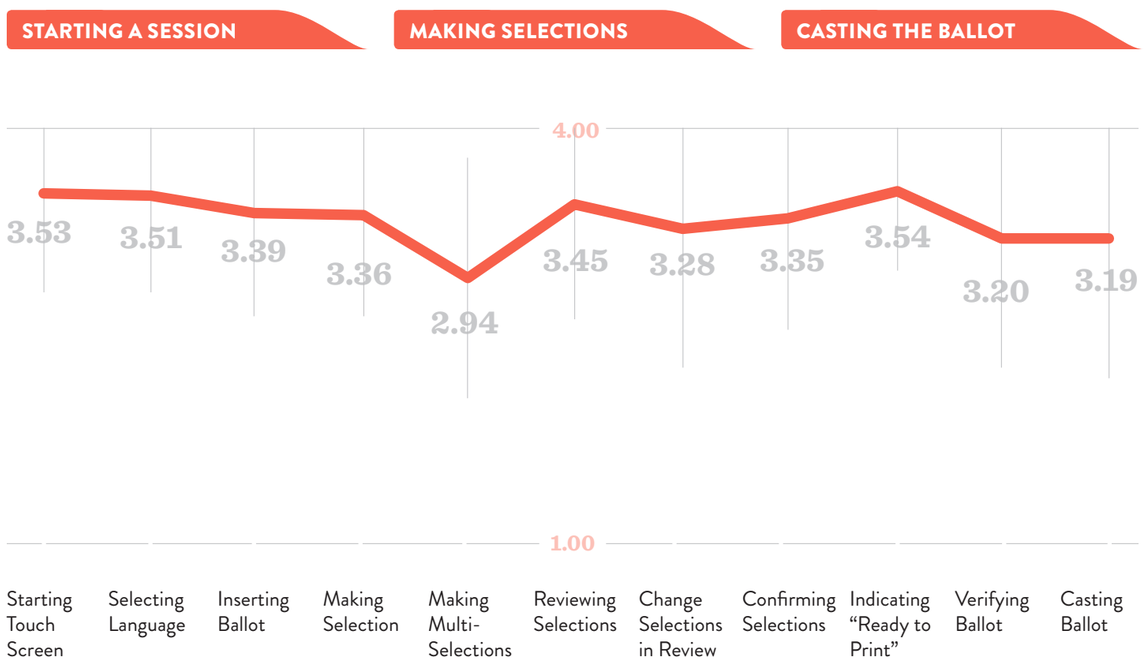
1. We will refine the approach to multi-select contests, as discussed in detail in previous sections. This includes improving the discoverability of the scrolling function and making the "below the fold" sections more visually apparent.
2. The print-verify-cast sequence of tasks will also be refined, providing voters with a preview of the actions to expect using simple illustrations, text, and animated graphics during key moments in the voting experience.
3. We expect that voters who face traditional access challenges might need some support during the transition years from InkaVote to the new system. Although all research participants could find and use the headphones and keypad, we found that having pollworkers direct them to an available BMD and then show them how to find the keypad and headphones made the experience easier and, quite possibly, more delightful. We anticipate that after these users have experienced the system once, orienting themselves to the system for the second time will be substantially simpler.
4. We will create a product form that reinforces the connection between ballot slot and ballot box, which might (subtly) help people understand about casting after verification.
5. We will design a lighter appearing monitor, which may encourage people to adjust it to a comfortable angle.
6. We will develop and implement a wider landing area for the keypad controller, with a "floating" stance where it sits on a platform to invite people to lift it off the unit and hold it in their hands (or leave it in place--up to them).
7. We will provide a relieved surface "dish" below the paper ballot in the output tray for people to reach fingers under the ballot and grasp it.

Touch Experience

EASE OF VOTING

Mean Usability Scores Across Voter Experience with Standard Deviations

1.00–4.00 SCALE:
1.00=Impossible | 4.00=Easy

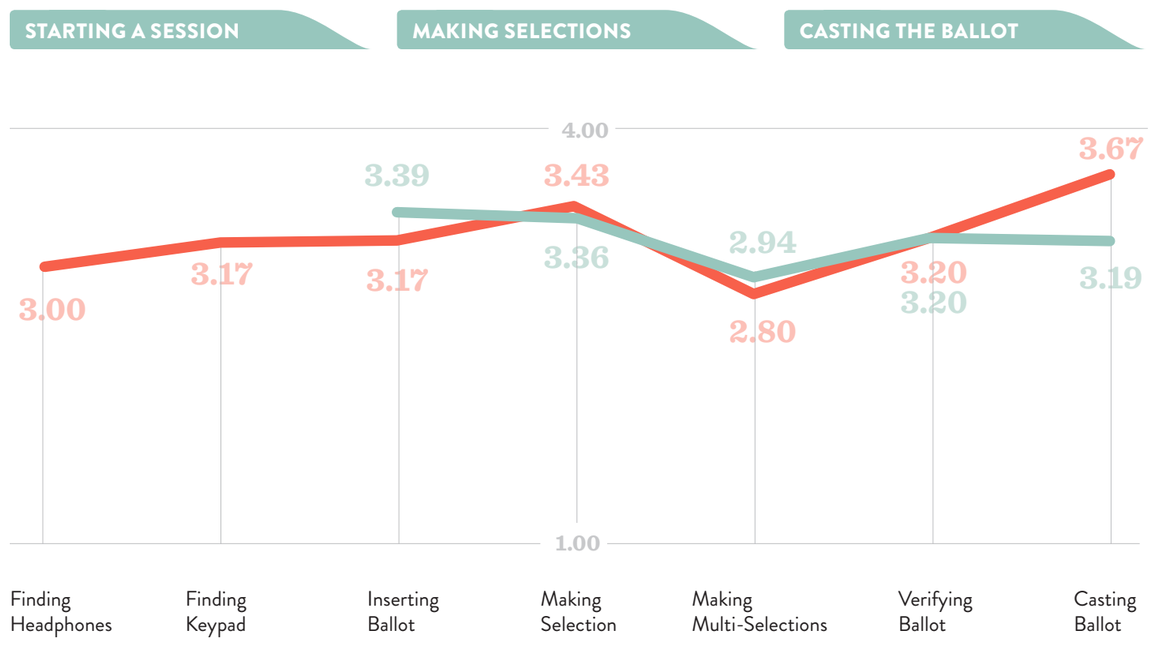


Audio Experience

EASE OF VOTING

Comparing Ease of Voting Across Audio and Touch Experience.

Audio Experience
Touch Experience



"When female veterans have PTSD, a crowd can be intimidating... So seeing a system much more user friendly, that's telling me that I can do it in 1-2-3."

USABILITY INSIGHTS & FINDINGS

TOPIC: Efficiency

BIG QUESTION: How might we design a voting system that is efficient to use?

WHAT WE'VE LEARNED: Average time was 10 minutes, with a range of 2 to 26 minutes. 79% of people felt it took "just the right amount of time".

DESIGN DECISION: These findings validate our system design decisions.

PRINCIPLES: Easy

BACKGROUND

As described previously, usability of voting systems is understood as the accuracy, ease, efficiency, and satisfaction experienced by users of a voting system. The third metric for evaluation is efficiency. As with other voting metrics, there is no gold standard for measuring efficiency and there are no standards for minimum performance. A thirty minute voting session might be fast and effortless for some and arduously slow for others. Efficiency is, thus, comprised both of a subjective metric of perceived time and effort as well as objective metric of the number of minutes to complete.

It is essential to note that, when it comes to vote, faster is not necessarily better. Fast might indicate that a voter did not understand their session or did not take the time to consider issues or candidates. One hotly discussed way to increase efficiency, for example, is to allow a one-click straight ticket option. Discussions with LA County, advisory boards, and subject-matter experts, however, have discouraged us from offering options that might allow voters to make selections without considering each contest. They argue that efficiency would be gained, in this case, by sacrificing the quality of decision-making.

Nevertheless, we recognize that creating quick and easy ways to vote might enhance the voters' satisfaction with the experience and, perhaps, even encourage busy people to come out to the polls. Enhancing efficiency might also decrease waiting times at busy polling places. Long wait times have been considered an inexcusable barrier to voting. So, our design challenge is to encourage high quality decision making while decreasing the actual amount of time it takes to vote. Tools such as the Interactive Sample Ballot might help us address this challenge by separating the time it takes to make decisions from the time it takes to vote.

FINDINGS

During research sessions, the IDEO team measured perceived time and actual time to complete a 22-contest election. To calculate the amount of time it took to vote, we used analytics software to indicate the time from starting the session to casting the ballot. The average voter using the vote list took 10:00 minutes to complete the session with a range from 2:33 to 25:10 minutes. Observers noted that the few outlying users who took much longer than the average were often providing a lot of design feedback to observers or their colleagues during the vote session. Perceived time was measured by asking participants "Once you started your voting session, how did you feel about the amount of time it took? Did it take way too much time, a little more time than you prefer, or just the right amount of time." Perceived time was important because, as we discovered, voters with different backgrounds had different thresholds for the amount of time and effort that seemed reasonable.

In response, 12% thought the voting session took too long, 9% thought it took a little longer than preferred, and 79% thought it took just the right amount of time. For those who felt positively about the system's efficiency, this enhanced their entire experience. Several veterans, for instance, pointed out that efficiency was critical for managing their post-traumatic stress. As one put it,

> "If you've got PTSD, you can be really intimidated very quickly. When female veterans have PTSD, it can be intimidating when there's a crowd, there's a lot of static with a lot of people talking. There can be intimidation in terms of how user friendly it is. Most female veterans, they don't want to be walking around with PTSD. I've got PTSD and major depressive disorder, so when I walk out of my apartment, I have to be feeling pretty good to do that. To take on the extra stress of society. It takes a lot for me to get out of my apartment. So me seeing a system being much more user-friendly, that's telling me that I can do it in 1-2-3. It didn't take long. I started to notice I was going faster and faster. When a system does that, that's very user friendly."

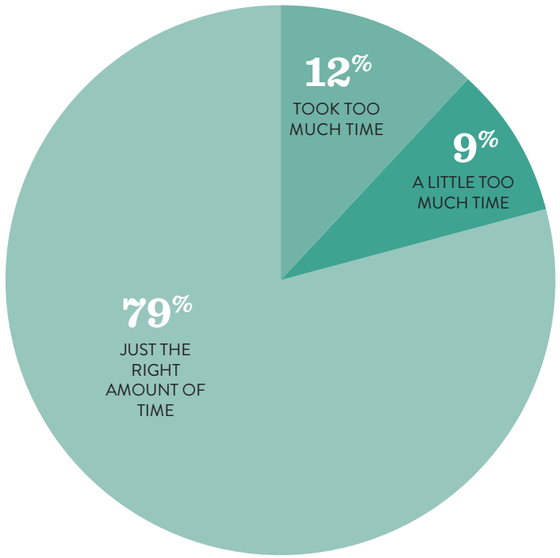
For some of those who felt that voting took too long, their feelings of inefficiency tended to be exacerbated by two issues: long wait lines before their voting session started and translation from English to their preferred language. This is exemplified by the fact that those who felt the experience was inefficient were disproportionately older (age 60-80+) Korean speakers who attended the fourth session. When asked about their experience, they spoke a lot about their trouble with the Korean translation. "These are not words I am familiar with and I am not sure I would have put it that way," one bilingual Korean-English speaker said. Many waited 30-45 minutes to start due to limits on the number of Korean speaking interviewers at the research sessions.

RECOMMENDATIONS

The overall efficiency of the system is reasonably high in terms of perceived time, with 79% of voters reporting that it took them "just the right amount of time," and objective time with a 10-minute average from start to end. Given the diversity of participants, and the reality of testing a prototype polling place, we conclude that these finding validate our system design decisions. Other efforts to reduce perceived time might include shorter waiting lines or taking advantage of waiting time to provide educational resources about the new voting system.

Time Experience

How did you feel about the amount of time it took to vote?

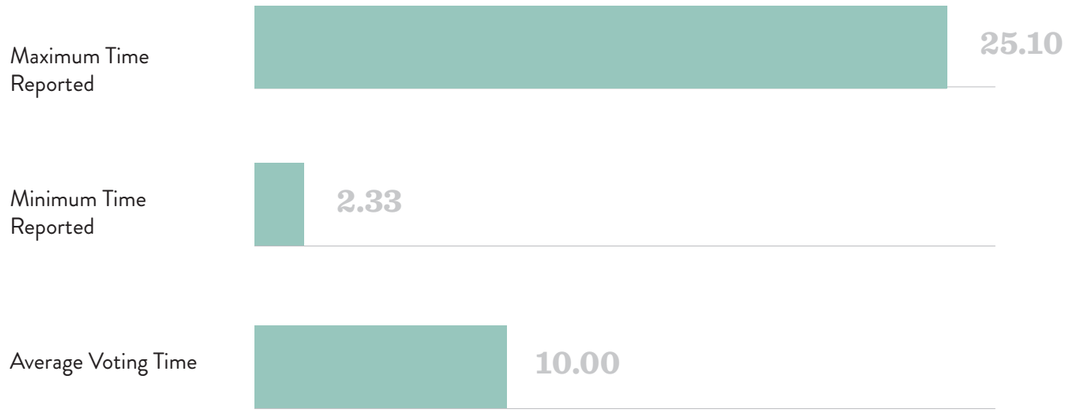


TIMED EXPERIENCE

79%

"Felt like just the right amount of time to me."

Time in minutes to finish voting.



"I get overwhelmed in situations like this. So many people, in a strange place. I am waiting in line and I get more anxious. My blood pressure goes up. I know it sounds crazy. For me, it has to be fast. I get in and I get out."

PRIVACY INSIGHTS & FINDINGS

TOPIC: Privacy

BIG QUESTION: How might we design a voting system that feels private to voters?

WHAT WE'VE LEARNED: Even given the lack of real privacy due to research observation, 86% of the voters felt privacy was preserved.

DESIGN DECISION: These findings validate our design decisions. Further privacy might be enabled by educating voters about the screen tilt function and positioning the voting booths inside polling places so that BMD screens are facing a wall or area without foot traffic.

PRINCIPLES: Private & independent

BACKGROUND

Since the earliest civilizations in Mesopotamia designed democratic voting systems, privacy has been a fundamental component of elections. Likewise, in any LAC voting system, protecting the privacy of the vote is priority. Given its importance, the IDEO team has evaluated privacy during every research session, constantly refining our understanding of how hardware, software, and experiential features of the system might enhance real and perceived privacy. During the first holistic system test, we found that those who used a central ballot box felt their privacy threatened more than those who used an integrated ballot box. In this instance, privacy mostly concerned protecting the paper ballot as it was completed, transported across a room, and inserted into a ballot box that was staffed by a pollworker. During pollworker research sessions, we found that perceived privacy was greater for prototypes with larger and less transparent shields.

During this latest round of research, we continue to learn about enhancing privacy. We have consistently found that privacy is difficult to evaluate in research contexts, particularly because participants are aware of the being observed. The lack of privacy during Los Angeles sessions was even further exacerbated by the presence of film, television, and photo crews from local and national news outlets.

FINDINGS

At the conclusion of the voting process, voters were asked an open ended question; "If this set up was used in a regualar election, how would you feel about the privacy of the booth?" Across all voters who responded to this question, 86% expressed favorable feelings about this system adequately protecting their privacy. When interviewers probed on the experience of privacy, most remarked that privacy was not a general concern of theirs during a voting session and that they felt fine with others knowing about their selections. Those who were concerned tended to feel most threatened by the large and bright touchscreen computer where they recorded their selections. They made statements like "It'd be pretty easy to see everything that I was voting for if you stood behind me and watched that big screen." Research observers who attempted to do exactly that (for the purposes of this study) found it to be more difficult than a voter might expect. None expressed concerns about the privacy of the ballot itself, feeling that it was not easily observed during the verification and casting process.

The IDEO team tested a few design features to enhance privacy. First, we included a slightly larger privacy screen on one of the units. Results revealed no meaningful or statistical difference in privacy ratings between the larger or smaller privacy screen.

Second, the IDEO team added a security film to the screen, which limited its viewability from the side. However, most users (79%) did not notices the film. When asked what they thought about this feature, one common statement was "No, I didn't know about it but I love the idea" and "I didn't know about the screen but it makes me feel more secure now knowing it."

Third, the IDEO team created a mechanism for the screen to tilt from vertical to roughly horizontal to the table. When horizontal, the screen was less viewable by people behind the voter. However, 69% of voters did not notice this feature and never discovered that the screen angle could be changed.

As a sub-experiment, the IDEO team evaluated any changes in perceived privacy after they altered the way that the booths were set-up in the polling place. When the team turned the booths so that the screen faced a wall, and the voter then stood facing people waiting to vote, perceived privacy went up from a score of 80% to 89%.

RECOMMENDATIONS

This research session found surprisingly high privacy ratings at 86%, especially given the lack of real privacy during media-intensive and observer-intensive research sessions. While these results may have been partly due to an overall nonchalance regarding privacy, these ratings validate our design decisions. To enhance voters' ability to protect the privacy of their screen, we recommend the following:

1. Educating voters about the screen's tilt function as well as the screen's privacy film. We also encourage polling places to arrange booths with touchscreens facing a wall or other area with minimal foot traffic. This provides more privacy to voters and also adds an element of comfort for the many voters who do not like having their backs to a crowd of other people.
2. Although a smaller screen size might enhance privacy, we do not recommend that decision because it conflicts with findings from the first two research sessions that found larger screens to be more accessible and usable.
3. For the audio + controller experience we will continue to refine the "screen on/off" feature to give voters the ability to preserve their privacy by turning the screen off and receive assistance from others by turning it on.

"I felt comfortable, even though I knew someone was behind me. I felt that she couldn't see what I was doing. The height of the machine was perfect...I had enough space to feel comfortable, it wasn't too small that I felt confined."

TRUST INSIGHTS & FINDINGS

TOPIC: Confidence

BIG QUESTION: How might we design a voting system that gives voters the confidence that their votes will be accurately counted?

WHAT WE'VE LEARNED: 92% of participants trust the new system.

DESIGN DECISION: Provide voters with comprehensive information about how votes are monitored, protected, and tallied in this new system.

PRINCIPLES: Trust

BACKGROUND

It is critical for voters to trust their voting technology. Democracy, in many ways, is a system that is reliant on citizen's confidence in the process, a willingness to participate in its operations, and ability to rely on its results. Confidence is measured in polling places across the world and this metric may be a part of the certification process. Most typically, trust is measured by asking voters whether they "trusted that this system would successfully record their votes during an election."

It is challenging to measure trust during a prototype experience. In our simulated research scenario, every attempt was made to recreate a final voting experience. However, due to logistical limitations, it was necessary for IDEO team members to replace printed ballots inside the integrated ballot box between each voting session. Voters experienced technical errors that are very unlikely to be a part of a fully developed system, such as the need to manually reset BMDs in between sessions, the frequency of paper jams, and bugs emerging from testing a web-based and internet reliant user interface. As a result, those voters who watched the team open up BMDs to reset or replace blank ballots with pre-printed ballots may have, quite naturally, questioned the trustability of this system. It was clear, however, that many voters understood the theatrics of the test. Clear language was used to convey this prior to starting the voting experience. Perhaps as a result of our attention to this communication, voters rated the system highly in terms of trust.

FINDINGS

During these research sessions, 92% of participants reported that they "trusted that this system would successfully record their votes during an election." Among the small percentage of people who did not trust the system, many described feeling uncertain about electronic voting. A few described the technical errors or prototyping fixes that they watched the IDEO team attend to and were clearly uncertain about whether these challenges would remain in the final system.

RECOMMENDATIONS

Confidence in this system, although only a prototype, was quite high at 92%. As such, the IDEO team is satisfied with these results. Of course, an important part of rolling out the new system will be educating the public. In particular, voters need to understand that the BMD is not tallying their votes and that the paper ballot is still the official vote of record. Although the system provides some indication of these facts, a more comprehensive educational campaign will be essential. We recommend the following:

1. Institute a comprehensive educational campaign that provides information about the voting machine function.
2. Attend to the recommended optimizations related to protecting the privacy of the vote, described in the previous section.

INTERACTIVE SAMPLE BALLOT (ISB/POLL PASS)

TOPIC: ISB/Poll Pass Experience

BIG QUESTION: Can a system be put effectively in place that allows users to pre-select at home and quickly execute their vote via scanner at the polling place?

WHAT WE'VE LEARNED: ISB was well received by voters, however voters struggled with the usability of the scanning process.

DESIGN DECISION: Improving the scannning angle and depth of field for the ISB scanner on the BMD. Improving communication regarding the ISB scan location and clarifying all steps in the ISB protocol.

PRINCIPLES: Easy.

BACKGROUND

In addition to testing the experience of voters using the touch screen and audio immersive capabilties of the Ballot Marking Device (BMD), our polling place experience also selected a small sample of voters from four of the five sessions to take part in using the Interactive Sample Ballot (ISB), also known as Poll Pass. Poll Pass systems (in use in several counties across the US) allow voters to premark selections privately and independently at their convenience at home, in transit, at work, or any other networked location. Voters can then bring a Quick Response Code (QRC) via self-printed paper or a mobile phone to any polling place and quickly transfer selections to the BMD via the optical scanner.

Throughout different sessions, some voters were invited to participate in the Poll Pass experience. These voters were first shown a short introductory demonstration that explained the Poll Pass protocol. They were then given a blank ballot and printed QRC sheet and instructed to use one of the BMDs. Observations and interview protocol were similar to other voter participants, only focusing more specifically on the Poll Pass experience.

FINDINGS

Although all 14 of the voters who participated in the Poll Pass experience found the initial process of scanning the poll pass accessible, half of those indicated that the experience was hard. In fact, of the seven starting steps (starting a touchscreen session, finding headphones, finding keypad, selecting language, inserting ballot, starting an audio session, and scanning Poll Pass code), scanning the Poll Pass code was deemed the most difficult on our 1-4 scale with a 2.71 average score. While our results come from a relatively small sample, this result was corroborated by some of the comments in our exit interviews; "Scanning the QR code was difficult...I actually had to crouch down to find scanner." Other voters indicated that not knowing what a "QR" code was exactly perhaps resulted in the initial confusion. "QR is not an intuitive word... who knows what a QR code is?"

Despite these initial difficulties with the scanner, Poll Pass users were genuinely excited about having access to a Poll Pass system and tellingly, 12 out of the 14 users felt pretty or really confident that the system would record their votes. Positive voter comments ranged from, "It is a faster and more convenient way to cast your ballot." and , "Scanning QR codes on the phone instead of paper, everything digital would be awesome!"

Critiques about the experience, besides the initial scanning difficulties, were far fewer. Voters were mixed about feeling that the orientation instructions were clear as opposed to feeling a need for a more thorough breakdown of the protocol. As the Poll Pass voters tended to be more highly educated than the average touchscreen voter (43% of Poll Pass users had a least a Master's degree vs. 16% of the larger sample), these findings should be viewed with caution and extra steps should be taken to ensure that communication is clear regarding the Poll Pass protocol and purpose.

RECOMMENDATIONS

There are specific design changes that should be made to improve the ISB experience. They all focus on making the act of scanning the QR code easier.

1. Adjust the angle of the scanner, so that voters do not need to reach far under the machine to present their QR code and so that the targeting marks projected by the scanner are more visible.
2. Position the scanner within the BMD housing in a way that makes the depth of field (where in space the scan is in focus) include the area right up against the scanner window. This allows people to touch their QR code to the scanner itself, an initial voter behavior that we observed.
3. Improve the clarity of the animation guiding users to the scanner.
4. Visibly distinguish the scanner indicator light from the scanner itself.

ISB Vote Experience

EASE OF VOTING

Comparison of easy map for selected steps between ISB Voters (Poll Pass) vs. Touch Screen Voter

1.00–4.00 SCALE:
1.00=Impossible | 4.00=Easy

ISB Voter
Touch Screen Voter

STARTING A SESSION

CASTING THE BALLOT

Appendix
(Data Collection Instruments)

English

Vox Observations

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PART 1: POLLWORKER OBSERVATIONS

Which BMD is the voter using?

- A
- B
- C

Is this voter using the immersive audio session, for people with visual impairments?

- Yes
- No

Which language is this voter using?

- English
- Spanish
- Korean

Did this voter get started with the Poll Pass?

- Yes
- No

Step 1: Getting started

	This step was...				Voter asked for...		
	impossible	hard	ok	easy	info	assistance	nothin'
Finding headphones	○	○	○	○	☐	☐	☐
Finding keypad	○	○	○	○	☐	☐	☐
Starting touchscreen session	○	○	○	○	☐	☐	☐
Starting audio session by pressing center-select key.	○	○	○	○	☐	☐	☐
Selecting language	○	○	○	○	☐	☐	☐
Inserting ballot	○	○	○	○	☐	☐	☐
Scanning Poll Pass code	○	○	○	○	☐	☐	☐

Step 2: Making selections

	This step was...				Voter asked for...		
	impossible	hard	ok	easy	info	assistance	nothin'
Making selections	○	○	○	○	☐	☐	☐
Multi-select contests	○	○	○	○	☐	☐	☐

Step 3: Review selections

	This step was...					Voter asked for...		
	impossible	hard	ok	easy	not done	info	assistance	nothin'
Reviewing selections	○	○	○	○	○	☐	☐	☐
Changing selections via review	○	○	○	○	○	☐	☐	☐
Confirming selections	○	○	○	○	○	☐	☐	☐
Indicating "ready to print"	○	○	○	○	○	☐	☐	☐

Step 3: Review selections

	This step was...						Voter asked for...		
	impossible	hard	ok	easy	user didn't do	don't know	info	assistance	nothin'
Reviewing selections	○	○	○	○	○	○	☐	☐	☐
Changing selections via review	○	○	○	○	○	○	☐	☐	☐
Confirming selections	○	○	○	○	○	○	☐	☐	☐
Indicating "ready to print"	○	○	○	○	○	○	☐	☐	☐

Step 4: Verifying & casting ballot

	This step was...					Voter asked for...		
	impossible	hard	ok	easy	not done	info	assistance	nothin'
Verifying ballot	○	○	○	○	○	☐	☐	☐
Casting ballot	○	○	○	○	○	☐	☐	☐
Understanding that votes are cast	○	○	○	○	○	☐	☐	☐

Hey again, pollworker. Did we mention that you are doing great! To finish up, here are a few overall questions.

Did you see the voter toggle languages, to/from English?

- Yes
- Not sure
- No

Did you see the voter change any of the preferences, like font size and contrast?

- Yes
- Not sure
- No

Do you think the experience could have been easier if they did change the settings, ie font size or contrast?

- Yes
- Maybe
- No

Did the voter adjust the **screen angle** at any time during their session?

- Yes
- Not sure
- No

Were there any system problems, like paper jams or unexpected bugs, during this session?

- Yes
- No

Did the voter seem to use the **vote list** for every contest?

- Yes
- Not sure
- No

All done, pollworker!

Please give this iPad to the interviewer to finish the follow-up questions.

Vox After Party

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PART 2: INTERVIEWER SESSION

Hey interviewer! Start here. And please add your initials.

Interviewer Introduction
You did it! Thanks for trying out this new voting system. First, let me introduce myself. I am _____ and I am here to get your ideas about how to improve this new way to vote. We need your help. From now until July, we will improve it constantly, working on dozens of versions. So, please talk to us about how that went and tell us about what you think might be better. Be as honest. Don't worry, you won't hurt anyone's feelings.

What were 3 things that worked well about that voting experience -- when I say the voting experience, I mean going to the booth and using the new set-up to vote?

What are 3 things that did not work well about that voting experience?

Seems like getting started was a little confusing. You had trouble finding what you needed to use the audio system. Tell me about what that was like. What could have made that easier for you?

When you first arrived, you learned how the Poll Pass works. What did you think of the short introduction that you saw on the computer? How confusing or clear was it? What could we make the Poll Pass easier to understand?

We are working on making it easier to get started and, particularly, inserting the ballot into the slot. Tell me about what step was like for you. How could it be easier?

You were one of the voters who tried out the Poll Pass. We want to know more about this experience. What did you like about it? What would you change or improve?

Scanning the code for the poll pass can be a little confusing. Tell me about how this step was for you? How could it be easier?

California elections can be really long and complicated. So, we want to find a way to make it easy to make all of your choices for candidates, bond measures, or other big decisions. Tell me how this went for you. What could we do to make it easier?

It seems like you did not move the screen angle while you were voting. You can adjust it like this (show with gestures). Did you realize that you could change it?

- Yes
- No

If you had known that you could move it, how do you think this might have changed your experience? How can we make this easier to figure out?

It seems like you did not change the font size or contrast while you were voting. You can make the font bigger or smaller and you can change the screen colors. But a lot of people don't realize that you can change these things. Did you see that you could change it?

- Yes
- No

If you had known that you could change this, how do you think this might have changed your experience? How can we make this easier to figure out?

You can have any part of the election read to you, by putting on the headphones and clicking on the audio-mode. Did you see that you could do this?

- Yes
- No

If you had known that you could have any part of the election read outloud to you, how do you think this might have changed your experience? Do you think you would have used this ability?

It is important to make sure that people who speak other languages can understand the issues on the election. On each screen, we created a way to switch back and forth between your language and English while you are voting. But not everyone knows how to do this. Did you see that you could switch back and forth?

- Yes
- No

If you had known that you could switch back and forth, how do you think this might have changed your experience? Would you like to be able to go between English and your language?

At the end of the session, you had a chance to review your votes, to see all of your choices and fix them before printing your ballot. We want to find a way to make it easier to review votes. Tell me how this went for you. What could we do to make it easier?

With this new way of voting, one of the biggest changes is printing out the paper ballot, checking to make sure that the paper ballot has your votes printed correctly, and then casting it back into the machine. We know this can be confusing! Tell us how this step went for you. What can we do to make it easier?

Thanks for all that feedback. It is really important for us to learn from you. We have a few more questions. We know that this is a special situation, with observers, but we'd like to hear your thoughts on privacy. If this set-up was used in a regular election, how would you feel about the privacy of the booth?

The voting screen has a layer of security film over the top of it that might make it more difficult to see from the side. Did you notice this? What kind of difference do you think it makes, if any?

How confident are you that this system would successfully record your votes during an election? Are you...

- really confident,
- pretty confident, or
- not confident at all?

We know that California elections can be very long and it can take a while to vote. This one had 21 contests. Once you started your voting session, how did you feel about the amount of time it took? Did it take...

- way too much time,
- a little more time than you prefer, or
- just the right amount of time for you?

This is great. To finish up, we just have a few questions about you. First, how old are you?

- 18-24
- 25-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80+

What's your gender?

- Male
- Female
- Other:

How would you describe your race/ethnicity? You can say half-Korean, half-English/Welsh. What ever describes you.

- [ ] Latino
- [ ] Asian
- [ ] Black or African American
- [ ] White or Caucasian
- [ ] Other:
- [ ] Other:

Let's talk about school. What is the highest level of school you finished?

- No formal schooling
- 1st to 8th grade
- 9th to 12th grade
- High school graduate (or equivalent GED)
- Some college but no degree
- Associates degree in college
- Bachelor's degree in college
- Master's degree (For example: MA, MS, MEng, MSW, MBA)
- Graduate or Professional degree (For example: MD, PhD, JD)

I am going to read a few sentences and you tell me which best describes your current financial situation.

- We don't have money for basics, like food;
- We sometimes don't have enough to pay our bills;
- We live month-to-month, just getting by;
- We have enough, but need to save more;
- We have enough to live comfortably, and even save; or,
- We have enough to live extremely comfortably and splurge.

Which of these statements fits? When it comes to the phone that you use most, you...

- ...use lots of apps and features.
- ...use it mostly for the basics like calling and texting.
- ...barely even use a phone to make calls.

Now let's try this one. When it comes to computers, you...

- ...use them all day, every day.
- ...use them a few times a week or so.
- ...barely ever use them.

What language would you prefer to vote in?

- English
- Spanish
- Korean
- Other:

Do you have any conditions or disabilities that might make voting difficult for you? It could be anything from vision loss to learning disability to limited use of arms or legs.

- [ ] Blind
- [ ] Low vision
- [ ] Arthritis or other joint pain
- [ ] Use wheelchair
- [ ] Use walker or cane
- [ ] Limited use of my arms
- [ ] Learning disability, like ADD, dyslexia, or hyperactivity
- [ ] Anxiety and/or depression
- [ ] On the autism spectrum
- [ ] Hearing loss or deafness
- [ ] Severe memory loss
- [ ] Speech or language disorder
- [ ] Prosthetic limb
- [ ] Have a hard time reading (low literacy)
- [ ] Limited gross motor skills
- [ ] Limited fine motor skills
- [ ] Other:
- [ ] Other:

Have you ever voted in the USA?

- Yes
- No

Thanks. Again, we really could not do this without you. Before you go, do you have any final advice for us?

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IDEO, 2015

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EXIT