



Pollster

Final Project Report



A report submitted in partial fulfillment of the requirements for the degree of
Master of Information Management and Systems

by

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the School of Information
University of California at Berkeley

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Acknowledgments

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Particular thanks to Bill Sherby and Rob Lenderman, whose availability was only matched by their eagerness to help.

The team also would like to recognize Professor Marti Hearst, whose feedback and guidance kept us on the path.

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Make smarter decisions.

Use Pollster to get quick, targeted feedback from experts.

I. Executive Summary

Project Description

Pollster is a system that seeks to bring together two markets of users with complementary needs and abilities. Pollsters and Voters.

Pollsters are individuals with a decision to make, for whom specific feedback from informed individuals would help them greatly. Pollsters format any question into a small 'micro-survey' and select who in our Voter Community they'd like to hear back from. Pollsters can pick which Voters based on filtering criteria like location, experience and age, or other 'learned' features like proficiency at math, experience in the retail sector or proven ability to identify winning energy stocks. While our system can be used to poll a crowd indiscriminately, the real power is in its ability to ask questions of individuals who can demonstrate expertise in some ability or area of knowledge.

Voters, are individuals with spare time and the desire to earn a little extra income. Voters are notified whenever a new poll arrives in their inbox, and are rewarded by Pollsters for answering polls and providing helpful feedback. Voters wishing to demonstrate some expertise may opt to take training polls aimed at showing Pollsters they know their stuff.

In its most recent iteration, this system has been tailored to support Pollsters trying to decide on which version of an online ad to run, in the hope that a smarter decision will drive more users to their website.

In Brief

- **Problem:** There's no easy way to get quick feedback from a group of experts.
- **Solution:** Pollster is a micro-survey platform aimed at polling experts for targeted feedback.
- **Users:**
 - Pollsters are users who need help making a decision. Pollsters use our system to create quick one-question 'micro-surveys', set rewards & select criteria that determine which Voters are invited to participate.
 - Voters are users with spare time and who want to earn extra income. Voters receive cash rewards for providing prompt feedback to polls they are invited to. Voters can improve their abilities by participating in training polls
- **Value:** Pollster has been validated as a method to help advertisers identify which version of an online ad is likely to be successful so that the need for A/B testing can be reduced or avoided entirely

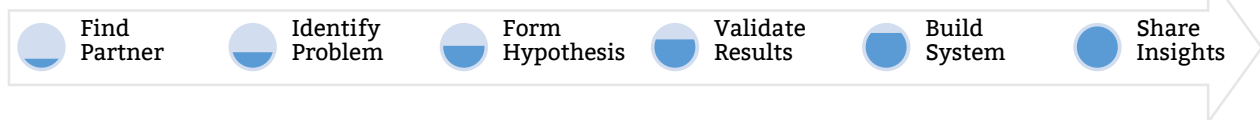
I. Introduction

Project Scope

Our team set out to complete a project that met two criteria above all. First, the project must address a real-world problem, not a hypothetical one. Second, the output of this project should be a product that stands alone: version 1.0 and not version 0.1.

In order to achieve the first of these, our team began early on to seek out partnerships with an organization in the local area that might sponsor our project. We hoped that doing so would direct us and keep our project goals grounded in the achievable. In brief, this all began with us adventuring to find an interesting problem we felt we could solve.

Project Map



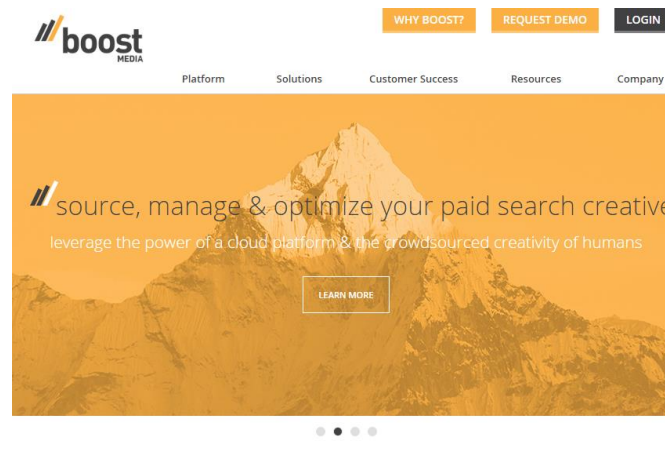
Our Project Sponsor: **Boost Media**

We were fortunate enough to have met our project sponsor at an event sponsored by the School of Information in the Fall of 2014.

About the company

Boost Media was founded in 2011 in San Francisco with the goal of empowering advertisers with a way to provide "rich, personalized creative" advertising at scale. Boost Media offers several services aimed at helping companies improve and optimize their online advertising and marketing campaigns. The value that Boost provides to its customers stems from a reliance on a combination of "the power of a cloud platform and the crowdsourced creativity of humans".¹

¹ Boost Media's website: <http://www.boostmedia.com>



Boost's three core service offerings are:

- **Boost Creative Core:** a cloud-based platform to easily source, manage and optimize ad creative assets at scale, and across marketing channels
- **Boost Creative Network:** a global network of handpicked writers and designers who are available to help customers develop and refresh creative concepts
- **Boost Insights:** A combination of machine-learning algorithms and data scientists, delivering customized insights customers' specific ad creative strategies and audience behavior

Background: Finding a problem to solve

Several meetings were set up at the Boost headquarters office located in San Francisco. This gave our team an opportunity to express our interests and strengths, and for Boost in turn to let us know of challenges they were facing.

Early in these discussions, one problem in particular stuck out – one that affects the entire online advertising industry and beyond.

Optimization

Boost's vision to enable ad companies to have access customized creative content is brought to life through what they call the Boost Creative Network. The way it works is that if a Boost client would like to try and improve a current ad, they are able to solicit a group of 1,000 ad-writers in-house to attempt and write an improved version.

After evaluating the different ads submitted in this way, the client can then authorize Boost to launch an 'A/B test' of the two ads with the goal of helping decide on an optimum version to keep up for a specific campaign.

A/B Testing

When a decision-maker has only two options to choose from but has insufficient information to decide which one is superior, they often opt to run an A/B test.

A/B testing is a type of randomized experiment used to determine which of two variants of some item performs better than the other according to a given metric. In the case of ad campaigns like those managed by Boost, A/B tests are performed by displaying version A of an ad 50% of the time, and version B for the other 50% in response to a given search term entered into a search browser.

After a certain number of ad 'impressions', meaning instances of an ad being displayed to a viewer, the results are then analyzed to determine which ad was most successful. Success could be measured in terms of click-to-impression ratio, or impression-to-purchase ration, or any metric that might interest that particular advertiser (Some websites, like blogs, may care more about the number of visitors who arrived at their page through an ad, rather than of how many customers actually signed up for something on the site.)

When A/B tests results reveal a clear winner according to the chosen metric, that new information empowers decision-makers to feel that they have made a smarter decision.

Drawbacks

As the Boost team explained to us, A/B testing is not a panacea. A/B testing has several unsurmountable drawbacks:

- A/B Testing is expensive, and often costs thousands of dollars for a single test
- Gathering sufficient results to interpret can take weeks
- A/B Tests often don't produce interpretable results²
- Because A/B Testing only works on 'unwitting' participants, results reflect actions but cannot capture any other feedback

² "Appsumo reveals its A/B testing secret: only 1 out of 8 tests produce results"
<https://vwo.com/blog/a-b-testing-tips/>

After running an A/B test, one may not be any closer to knowing which ad should remain in place. If tests A and B are shown 10,000 times each, and A received 102 clicks but B received 105 clicks, should that really be taken to mean that test B 'won'? This result also raises a host of other questions, with no satisfying answers. Does their receiving the same number of clicks mean they're just as effective as the other? Is the composition of users who clicked on version A the same as that of users who clicked on version B?

Even when A/B tests provide interpretable results, they often come with caveats: running the same A/B test on different months or even different days of the week can produce opposite results. Without a method to gather feedback during a test, analysts can only wonder why a test turned out the way it did, and what users think could be done to improve an ad.

The Need for Feedback

As described by Bill Sherby, Analytics Manager at Boost.

"The biggest challenge in A/B testing is having the ability to get quality answers from a crowd of people.

"Having [better] feedback allows us to understand what marketing messaging will work before putting it into the market. Which will save us money over time and in the long run and allow us to experiment more with marketing messaging overall."

What we took away from our initial meetings was this: A/B testing in its current form often fails to provide decision makers with explicit feedback that might support them making the smartest decision. This particular failing is most felt in scenarios when an A/B test fails to adequately resolve the question of which ad is more effective at driving users to click on the link.

With this, our team felt we had come across the kernel of a problem worth exploring. We secured our thinking caps and moved to cement a partnership with Boost to evaluate ways to help address this problem.

Our Partnership

Boost agreed to:

- provide us with access to members of their Analytics team
- facilitate an analysis of their historical A/B test data
- fund later stages of our research should we identify a need to send out surveys

In exchange, our team agreed to:

- work closely with the Analytics team to ensure continuous alignment of goals and success metrics
- share our project findings and experimental results
- demo our final project and
- make ourselves available to advise Boost on how to integrate our findings into their own systems and workflow

II. Research & Concept Testing

Data Analysis

Having been provided with access to the results of a large number of individual A/B test results, our team familiarized ourselves with ad formats, and the way test results were logged. We were then able to categorize test results into one of three categories: Clear Winner, Tie, and Undetermined (for the cases when insufficient results had been gathered to draw firm conclusions).

In analyzing this data, kept a question on our mind: might some people be able to identify which ad would receive the most clicks? If some individuals could do so, could we build a solution to capture this feedback?

Hypothesis Formulation

This process led us to form three hypotheses, which we would go on to guide our explorations for the remainder of the project:

Hypothesis 1

Presented with two versions of an A/B test, a subset of individuals may display an extraordinary ability to correctly identify a winning ad. Were a decision maker to have access to a group of these individuals, they could solicit feedback on which of two choices might arrive at an answer without the need to run a standard A/B test.

Hypothesis 2

While no specific individual is exceptionally able to predict the outcome of an A/B test, it is possible that polling a large group of individuals may help uncover the ad most likely to win. Were a decision maker to have access to a group of these individuals, they could solicit feedback on which of two choices might arrive at an answer without the need to run a standard A/B test.

Hypothesis 3

While neither individuals nor groups display an exception ability to identify winning ads, it is possible to train individuals to become better at discerning the winner of an A/B test. Were a decision maker to have access to a group of these individuals and if the correct training regimen could be established, decision-makers could solicit feedback on which of two choices might arrive at an answer without the need to run a standard A/B test.

Experiment Design

To test these hypotheses, we designed and conducted several surveys with two distinct groups of respondents.

As a guiding principle, we aimed to design our surveys to closely mimic the experience of viewing ads in their 'natural habitat'. The idea behind this was to try and replicate the viewing experience that led to the generation of our data.

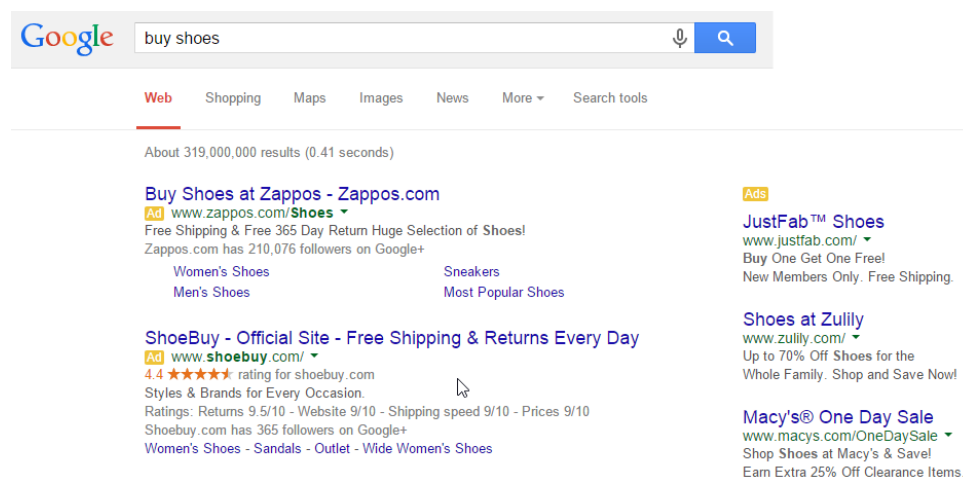


Figure 1. Ads in their natural habitat, displayed alongside search results in a browser.

Our Surveys

All of our surveys were constructed using SurveyMonkey.com, which allowed for certain randomization features, as well as advanced style editing which gave us great control over the ads. When we were not surveying Boost writers, we implemented a 'human-test' question to weed out respondents who might have been either answering the questions without reading them, or who were possibly malicious bots instead.

Survey 1

Design:

Instruction text on first page, Ad A and Ad B displayed on same horizontal axis. Ads displayed in same format as they appeared on the web, text displayed in black.

Randomization:

To reduce likelihood of bias for left or right side of the screen, ads were randomized to appear on either the left or the right side of the screen.

Goals:

See whether any writers in the Boost Creative Network display extraordinary ability in identifying winning ads.

Question Selection:

20 Ads were chosen which met the following criteria:

- The winning ad received more than 200% the number of clicks of the losing ad
- A variety of industries

Responses:

28 writers in the Boost creative network.

Results:

- Support for rejecting hypothesis 1, as no individual correctly identified more than 6 of the correct ads in the survey.
- Support in favor of a modified version of hypothesis 2. The overall group performed no better than might be expected with random chance. The distinct subgroup composed of individuals who could each identify at least 5 of the 10 ads correctly performed significantly better than random; tallying their votes would have led to the correct identification of 7 of the 10 winning ads in the survey.

Survey 2

Design:

Instruction text on first page. Additional effort to better replicate experience of viewing ads in browser. Associated search terms provided above ads, Ad A and Ad B displayed on same horizontal axis. For Google Ads: displayed in same format as they appeared on the web. First line presented as blue hyperlink, second line as green URL, and remaining text in black. For Bing ads: displayed in same format as they appeared on the web. First line presented as blue hyperlink, remaining line in black.

Randomization:

To reduce likelihood of bias for left or right side of the screen, ads were randomized to appear on either the left or the right side of the screen.

Goals:

- See whether any individuals in a random 'crowd' of web users might display extraordinary ability in identifying winning ads.
- Validate modified version of Hypothesis 2 to see whether subgroups of individuals can correctly identify winning ads
- See whether we could more closely mimic the web ad environment
- Evaluate SurveyMonkey's Audience service as a methodology for conducting future surveys

Question Selection:

After careful re-evaluation, more stringent criteria were deemed necessary to filter out ads which may have contained noise in the data.

10 Ads were chosen which met the following criteria:

- The winning ad received more than 200% the number of clicks of the losing ad
- Each ad received a minimum of 4,000 impressions each
- Each ad received an equivalent number of impressions, to ensure their results could be compared
- Each ad received a minimum of 10 clicks each
- A variety of industries

Responses:

162 paid respondents recruited using SurveyMonkey Audience service.

Results:

- Support for hypothesis 1: 10 individuals correctly identified 8 or more questions in the survey. Though, consideration was taken of the possibility this was due to chance.
- Additional support for a modified version of hypothesis 2: individuals who had correctly identified more than 6 of the correct ads in the survey, as a group, correctly

identified more than 70% of the ads in the survey. This indicated that it may be possible to create 'filter' questions and find some users who would be better and identifying winning ads than other users.

- Support in favor of a modified version of hypothesis 2. The overall group performed no better than might be expected with random chance. The distinct subgroup composed of individuals who could each identify at least 5 of the 10 ads correctly performed significantly better than random; tallying their votes would have led to the correct identification of 7 of the 10 winning ads in the survey.

Survey 3

Design:

Instruction text on first page. 5 training polls provided, followed by answers to training polls and tips for approaching ads. Same replication of experience of viewing ads in browser as Survey 2. Associated search terms provided above ads, Ad A and Ad B displayed on same horizontal axis. For Google Ads: displayed in same format as they appeared on the web, First line presented as blue hyperlink, second line as green URL, and remaining text in black. For Bing ads: displayed in same format as they appeared on the web. First line presented as blue hyperlink, remaining line in black. After each question, respondents are asked to provide text feedback explaining why a specific choice was made.

Randomization:

To reduce likelihood of bias for left or right side of the screen, ads were randomized to appear on either the left or the right side of the screen.

Goals:

- Validate Hypothesis 3 by seeing if providing training could help improve results
- Gather feedback on a per-question basis from respondents to attempt to identify thought processes behind decisions
- Validate modified version of Hypothesis 2 to see whether subgroups of individuals can correctly identify winning ads
- Evaluate whether treating early questions as an 'entrance exam' for filtering later responses could help select for more successful group of respondents

Question Selection:

5 training Ads were selected from survey 1

15 Ads were chosen which met the following criteria:

- The winning ad received more than 200% the number of clicks of the losing ad
- Each ad received a minimum of 4,000 impressions each
- Each ad received an equivalent number of impressions, to ensure their results could be compared
- Each ad received a minimum of 10 clicks each
- A variety of industries

Responses:

32 Boost writers.

Results:

- Support for hypotheses 2 and 3, as training uniformly improved results across survey.
- Feedback indicated tips and giving feedback was very helpful to the respondents

Survey 4

Design:

Instruction text on first page. 5 training polls provided, followed by answers to training polls and tips for approaching ads. Same replication of experience of viewing ads in browser as Survey 2. Associated search terms provided above ads. Ad A and Ad B displayed on same horizontal axis. For Google Ads: displayed in same format as they appeared on the web. First line presented as blue hyperlink, second line as green URL, and remaining text in black. For Bing ads: displayed in same format as they appeared on the web. First line presented as blue hyperlink, remaining line in black. After each question, respondents are asked to provide text feedback explaining why a specific choice was made.

Randomization:

To reduce likelihood of bias for left or right side of the screen, ads were randomized to appear on either the left or the right side of the screen.

Goals:

- Validate Hypothesis 3 by seeing if providing training could help improve results
- Gather feedback on a per-question basis from respondents to attempt to identify thought processes behind decisions
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- Each ad received a minimum of 10 clicks each
- A variety of industries

Responses:

162 paid respondents recruited using SurveyMonkey Audience service.

Results:

- Support for hypotheses 2 and 3, as training uniformly improved results across survey, though not as significantly as was shown with the Boost writers. Perhaps indicative that the additional training of the Boost writers (more familiar with the process) was the differentiator.

Results Summary and Validation

After reviewing the results of these surveys, and presenting the preliminary findings with Boost, we found our data supported the following conclusions:

- Individuals do not seem able to predict the outcome of A/B tests overall, however training can improve results by employing a 'learn by trial-and-error' approach
- Certain groups of individuals are able to predict the results of A/B test results. These groups can be selected for by filtering them out of the main group based on their previous answer history
- While not statistically as robust as large-scale A/B tests, this process demonstrates that the micro-survey approach to identifying better ads can be an effective way to help create an informed decision in a much faster turnaround and at a significantly lower cost (<\$20 per comparison, versus \$1000> for an equivalent A/B test)

III. Our Solution: **Pollster**

Having now delved deep into how Boost leverages people to support informed decision making regards to online advertising campaigns, we took a step back, and evaluated what we had learned.

First, we realized that the challenge faced by Boost was generalizable. At its most abstract, this problem can be expressed like so: it is difficult to get quality feedback from the right people. And it's even harder to get that feedback to get to you in a timely fashion – often when you need it most.

Whether the decision-maker in question is in a business setting or trying to come to a decision on an important life-choice, this problem persists.

Inspired by the lackluster feedback A/B tests provide to analysts, our system is, first, a micro-survey platform in which Pollsters can pose short questions and receive targeted feedback from experts. Second, our system enables a Pollster to develop training polls which can teach a community of Voters how to get *better* at helping them make their decision. For the voters, our system offers a way to earn side-income at home or on the go by responding to short polls based on their prior knowledge and experience.

Our solution is a platform which helps connect people with questions to the groups of most likely to be able to answer those questions.

Process

Pollsters

As a Pollster, you can create a poll and send it out to Voters in our system. This is the first activity you must engage in to begin interacting with the system.

A poll is a short question with only two possible answer choices. In addition to requesting for Voters to choose between either answer or a 'tie' option, you can request that the Voter respond in a text field and provide a text response of any kind. Typical uses for requesting feedback in this case might be to ask a Voter to describe why they believed for one answer to have been more likely than another. You also have the opportunity to provide any relevant information you would like for the voter to see alongside the poll, and you will be asked to provide information on how many responses you would like and what your budget is.

Now that you've created a poll, you can select which Voters you'd like to reach.

Our system aims to support filtering by characteristics like demographic information, as well as other 'experiential' features like previous answer history, and number of training polls they have answered. As an example, you may be seeking to gather responses only from people with a computer science degree so you might filter to only send to voters who have successfully passed a training poll on advanced computer programming.

As an alternative, you can also create training polls, which can serve to help you find Voters who are experts in a certain more area. Essentially, you would indicate that only voters who successfully answer a set of specific training polls may be allowed to help you answer your poll. A great way to ensure you only get feedback from the type of expert you're looking for.

You can also use training polls to help Voters get better at giving you high-quality feedback. If you have a number of polls you would like to pose to Voters, you may create a Polling Project: a series of polls, which you would like to pose to any Voter that meets some number of criteria you define.

Voters

As a Voter, you join our system and fill out a short demographic survey. At this stage you arrive at the Voter Dashboard which allows you to either begin voting immediately (on polls which are open to individuals with your characteristics), or you can elect to pass through a series of training polls for a specific polling project. For every poll available to you, you will be able to see the reward amount that a Pollster is offering for responses to that poll. Training polls may or may not contain reward incentives, however, some polling projects may require you to correctly answer a certain number of training polls before you become eligible to answer polls for which rewards are available. As training polls fulfill two uses, you may find it useful to complete as many of them as possible; some polls you want to complete in order become eligible to participate in paid polls, while other training polls exist to help you become better at answering certain types of questions. Answering more training polls for a Pollster who focuses on identifying which Facebook posts about teen fashion will perform better may help turn you into an expert in that niche area. This may make you one of the Voters they go to with tough questions in that category.

For each poll you respond to, you are able to see the dollar amount of rewards you are accumulating, and you can cash out at any time. If you're done answering polls for the day, you can sign out. You will be able to indicate you would like to receive an email notifying you that a new poll is available for you.

Use Case

Consider this example.

Joan is a marketing executive at a new fashion start-up and is two weeks away from the launch of a major ad campaign for their newest product, and there's a problem. Two slogans have been put forward as the best candidates to go on their online ads, but no clear winner has emerged after two months of discussion. Paralysis has gripped the creative team and Joan is stuck. There isn't enough time to enroll the services of a market research firm, and even if there were – they wouldn't be able to afford it. Making smart decisions can be difficult.

Alex is a stay at home parent who used to manage a chain of small retail stores that catered to the same clientele as Joan's company. Alex has been looking for ways to earn a little extra income for his family, but his kids keep him busy and his schedule is often erratic. He'd love a way to earn money while he's sitting in the school parking lot, or when he's in line at the grocery store. In a perfect world, Alex would love to be paid for doing something with his mind and not his hands.

The Pollster micro-survey platform is built to support informed decision-making by connecting individuals like Joan to a targeted crowd of experts just like Alex. By creating an account, Joan can create a one-question poll and can filter the Voter Community to ensure her poll only reaches the right kind of Voters. Alex's phone alerts him that a new poll has arrived in his inbox and tells him how much he'll receive for responding to it. Alex opens the poll, reads the prompt, selects the ad slogan his expertise tells him will best resonate with Joan's customers, and gives Joan some short feedback. After three days, Joan's poll has received feedback from 40 experts in the field, and she now has the insight she needs to move forward.

Project Summary

Our goal set out to build an original solution to a real need. Our team identified a partner company, and worked closely with their team to find a problem that would benefit our help. We identified a problem, developed and tested hypotheses and designed a complete system that we believe helps solve that problem.

Our system lets Voters earn rewards for responding to polls, and helps Pollsters gather this feedback to inform their decisions. Our surveys revealed to us that training was something worth investing in, and our system was designed to make this an integral part of the process.

We recognize that our system falls shy of the version 1.0 we had envisioned at the outset (though we feel proud that it currently exists, live, as a version 0.8), but we are confident of the fact that the system currently running at <http://www.Pollster.co> represents a meaningful body of work.

Our research has provided data that has been received as very valuable to Boost Media, our partner organization, and a preliminary presentation of our system has been received with praise from the lead of the team we have worked with for the past six months.

Reception of our Project by our Partner

"Having [the] type of feedback [gathered by Pollster] allows us to understand what marketing messaging will work before putting it into market. Which will save us money over time and in the long run and allow us to experiment more with marketing messaging overall.

"For [Boost] specifically, it allows us to experiment and write new messaging without the danger of harming the effectiveness of your marketing campaign.

"[Your project] would bring validation to our creative process, which could then be vetted through the voting system prior to clients seeing it, and prior to inserting everything into markets for market validation. This would increase the effectiveness of our platform.

"[Thanks to this,] we can expand our crowd and allow potential optimizers to be a part of the validation crowd prior to writing [Boost ads]. And we'd be excited to see if there was correlation between the predictors, and those who can write ads."

Future Work

Building out the remaining aspects of Pollster necessary for the system to remain live as a fully-functional site is the first priority of the team in the near future. Second, is to run user-testing with writers from the Boost Media Creative Network. And finally, it is our goal to run

follow-up surveys directly in the Pollster system in order to pursue additional investigation of the statistical significance of difference results.

IV. Design & Implementation

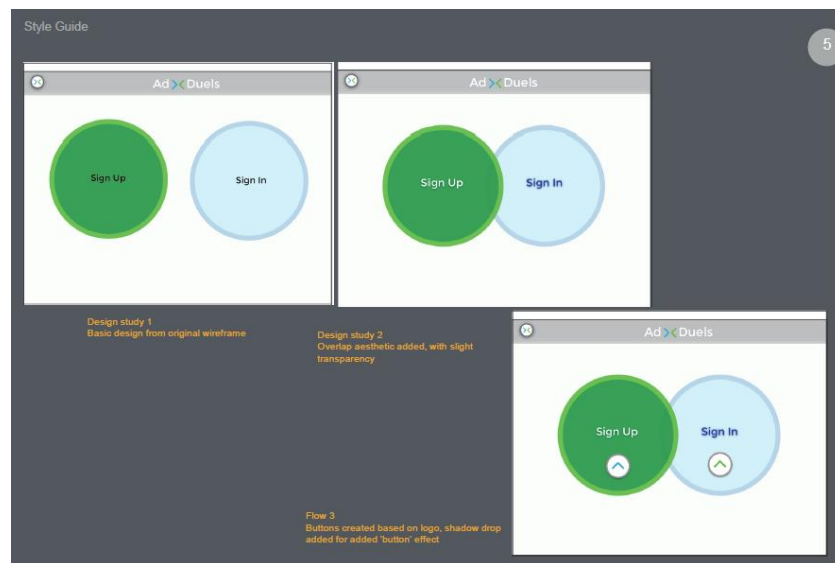
Design Constraints

We decided to design for web and mobile to support users at home, work or on the fly. As part of this process, we aimed to build something sleek, simple and functional.

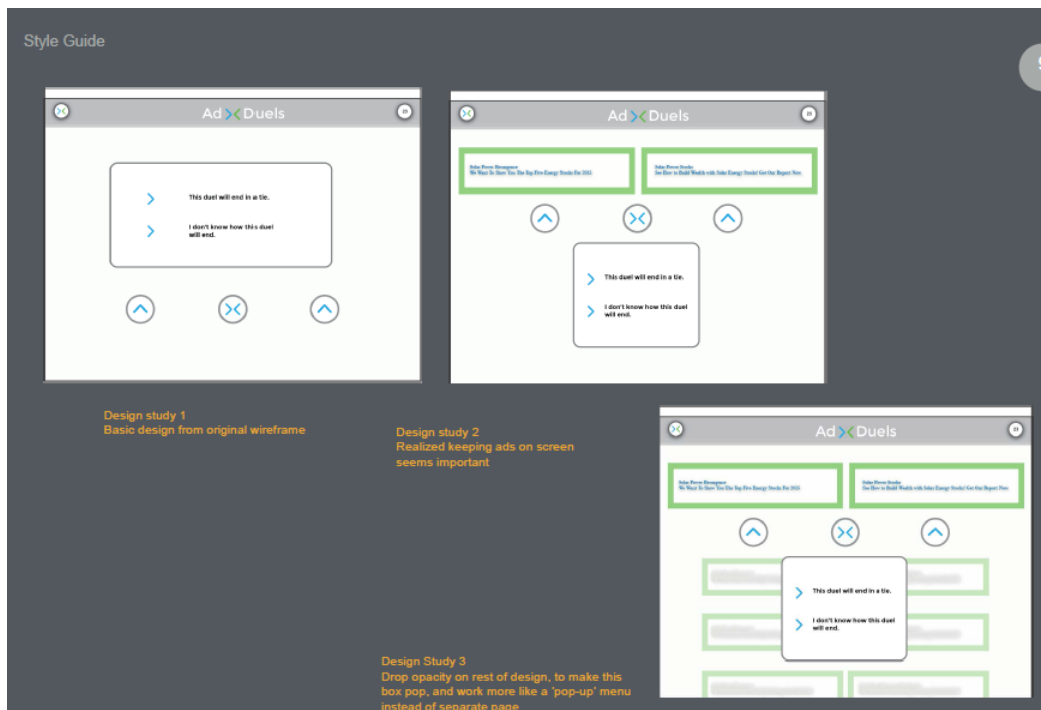
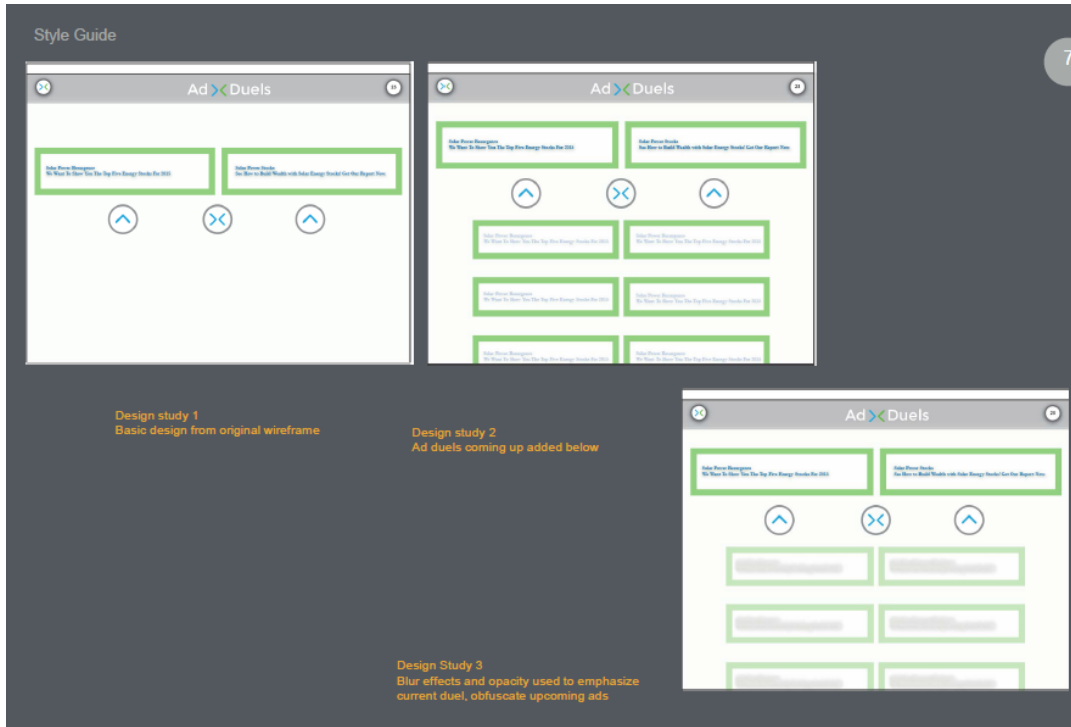
Interface Aesthetics and Iteration

Below are screens produced as part of the Interface Aesthetics course at the School of Information, which was leveraged as a way to receive feedback while iterating the design for this project.

Splash Page Designs:

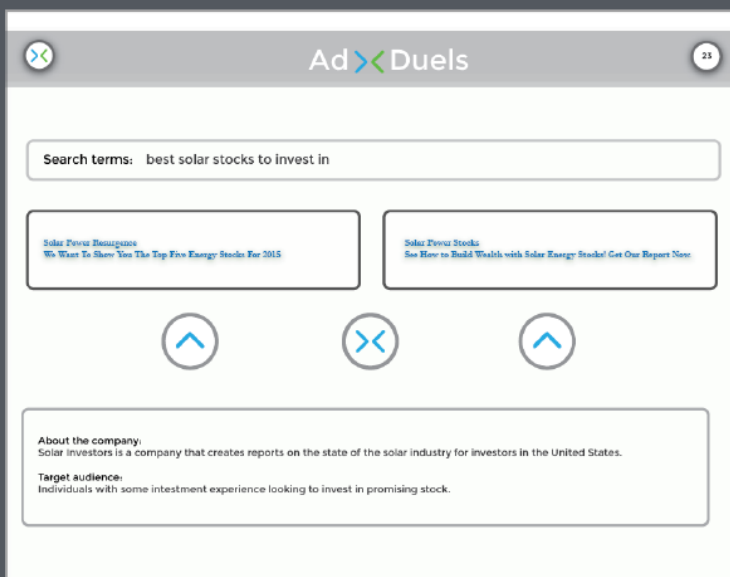
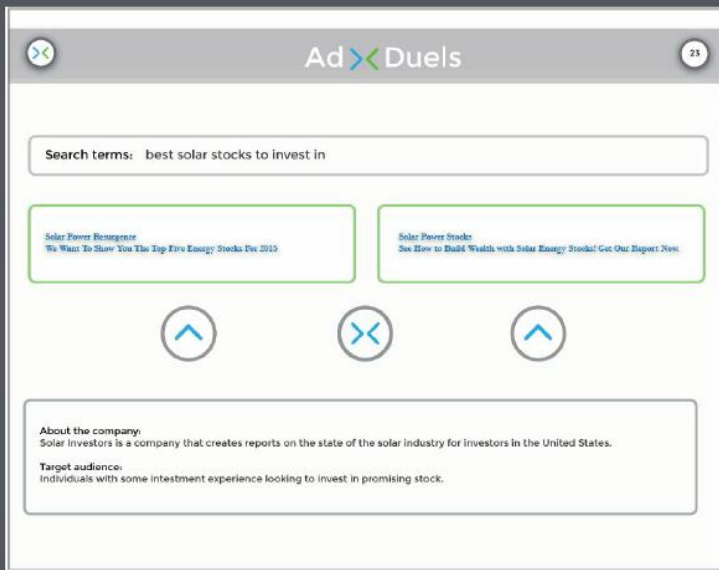


Voting Page Layout designs:



Color studies:

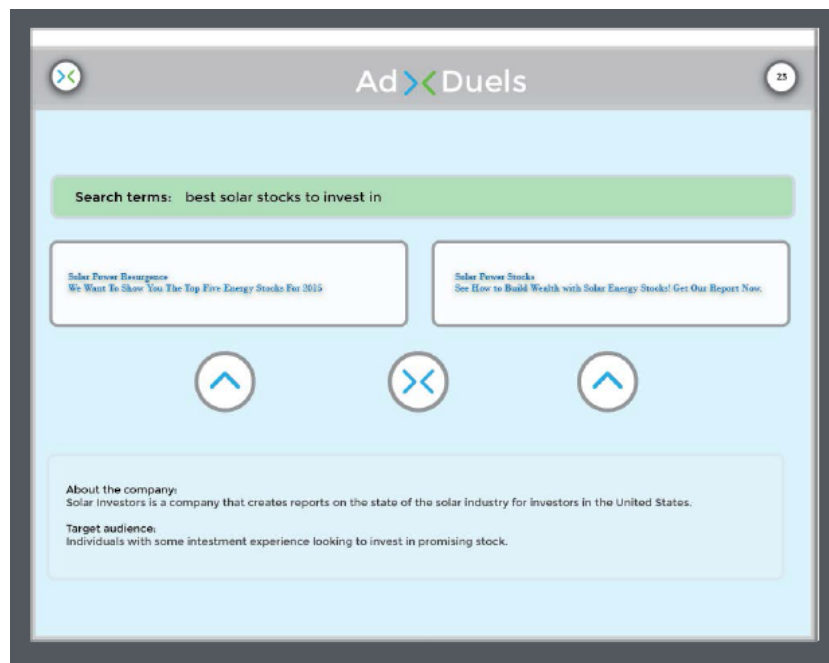
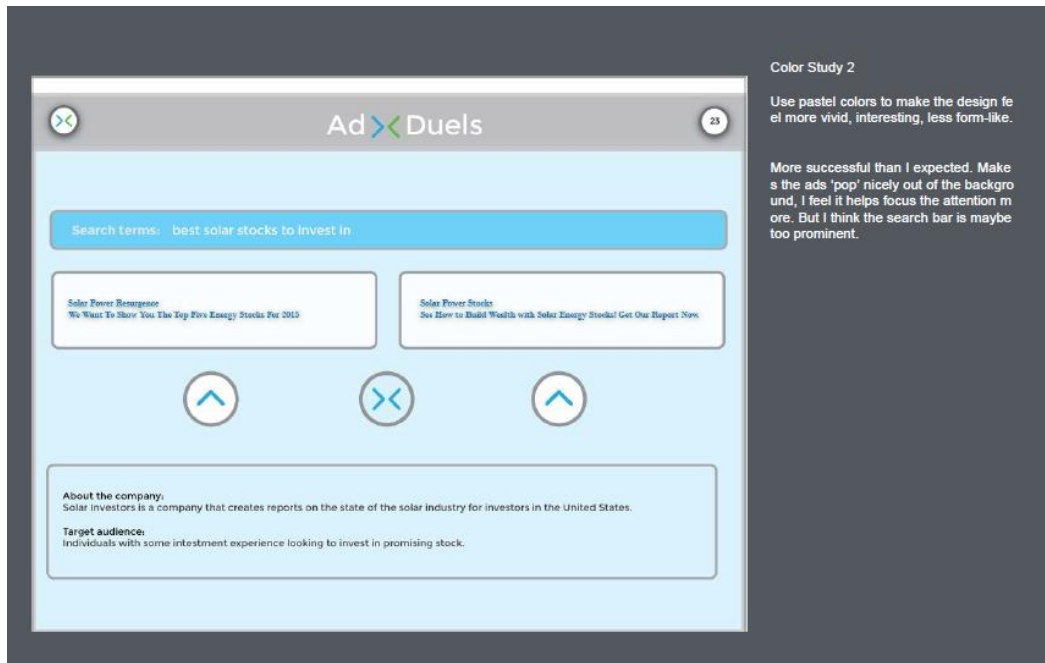
Most recent version of UI design before color study



Color Study 1

Use greys to clarify UI. Essentially, try and use neutral colors to try and do very little to distract the user.

I don't think it's very successful.



Final Design & Descriptions

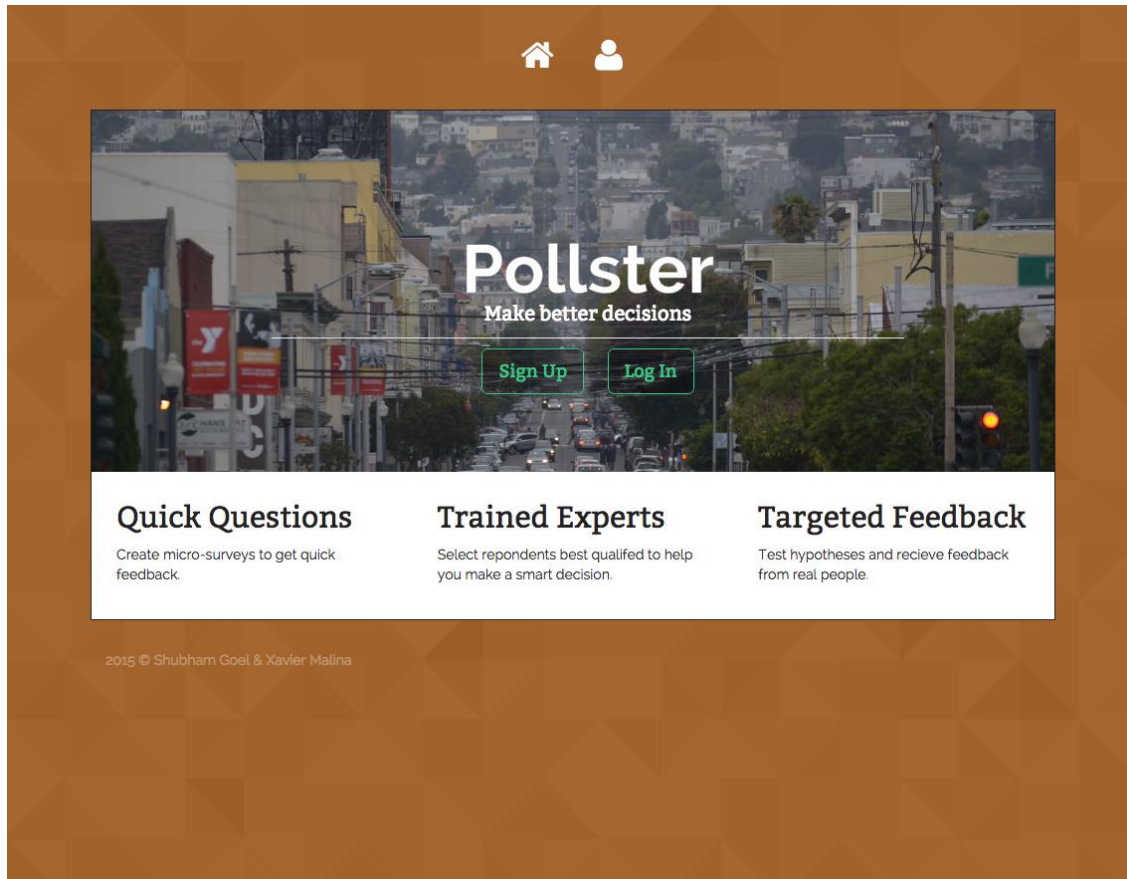


Figure: Home page

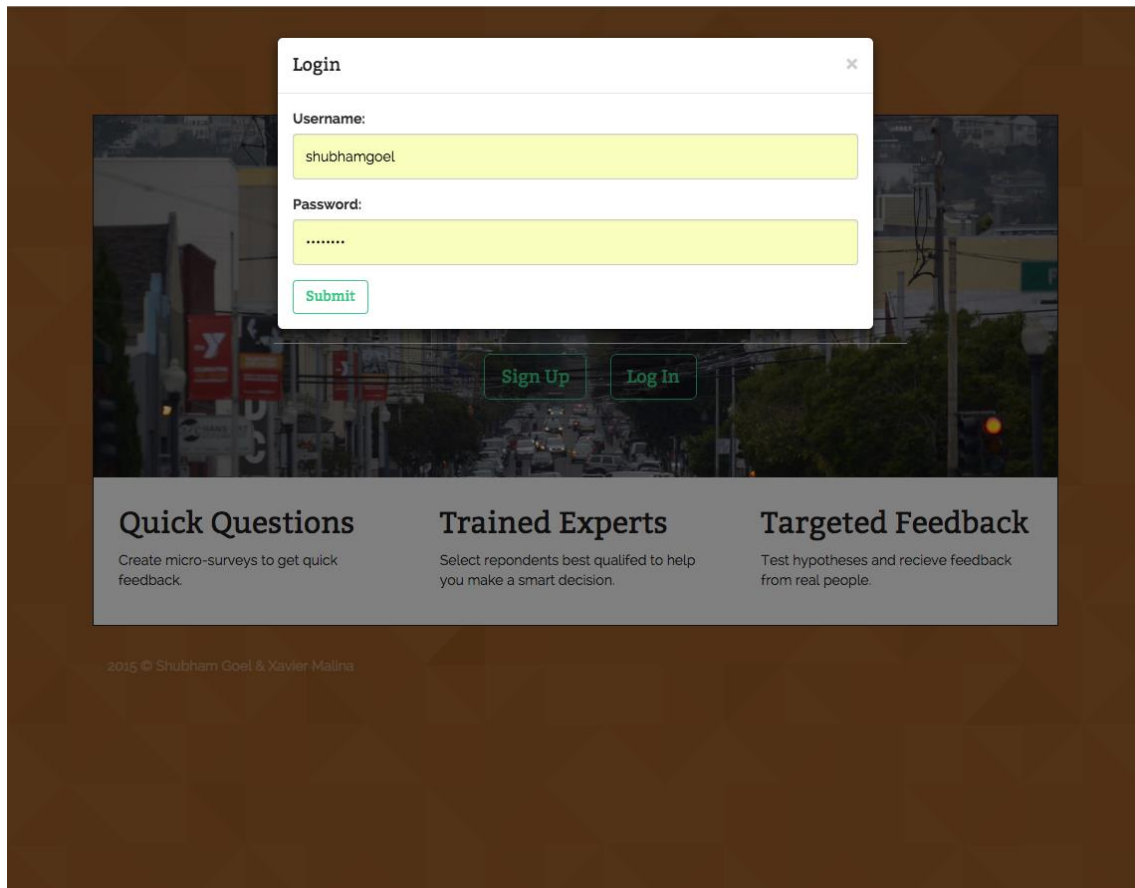


Figure: Login Modal View

The login and signup page appear as a modal views over the homepage. This keeps the user on the same page and prevent the need for navigating to register or gain access to the system.

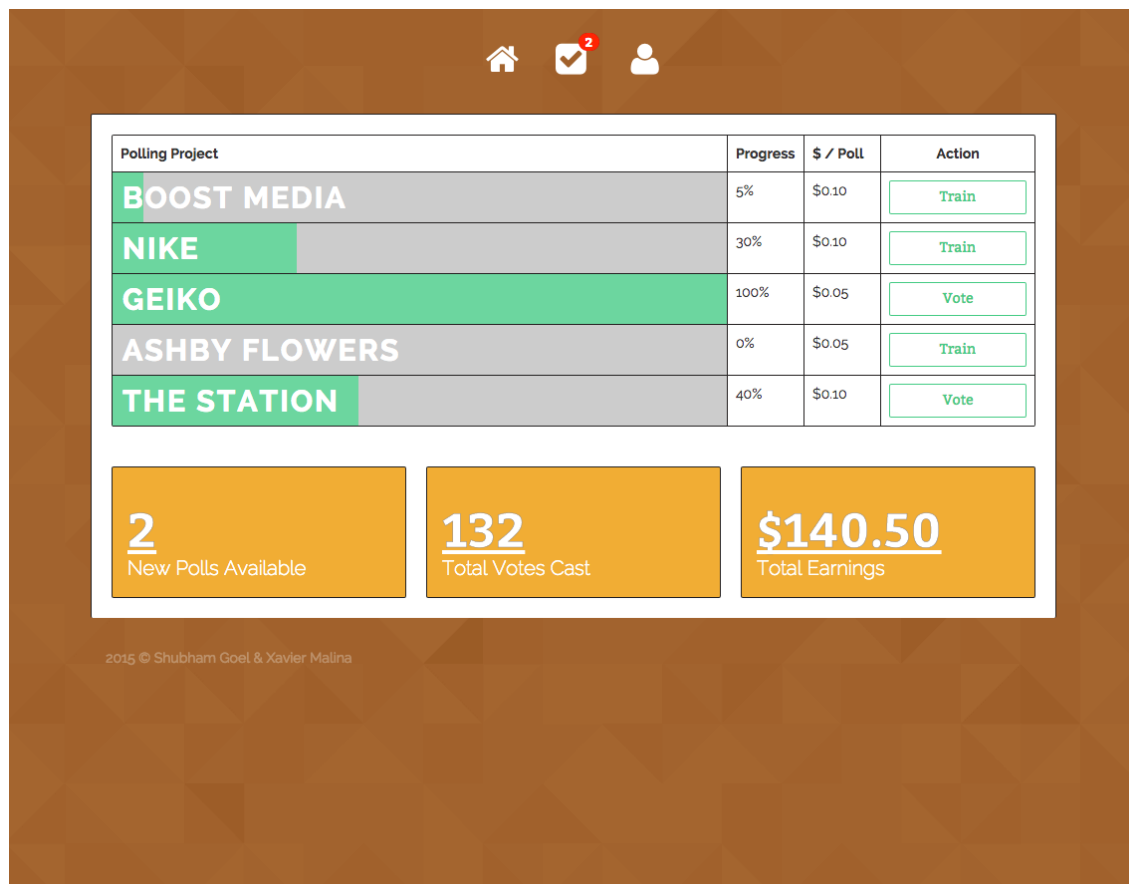


Figure: Voter Dashboard

After the Voter logs in, they can look at all the polling projects available to them. Some polling projects require the Voter to go through a training polling project before they can start casting their votes. On this page the user can see their current progress of different projects and training projects. They can also see their total earnings from the system that is available for them to redeem.

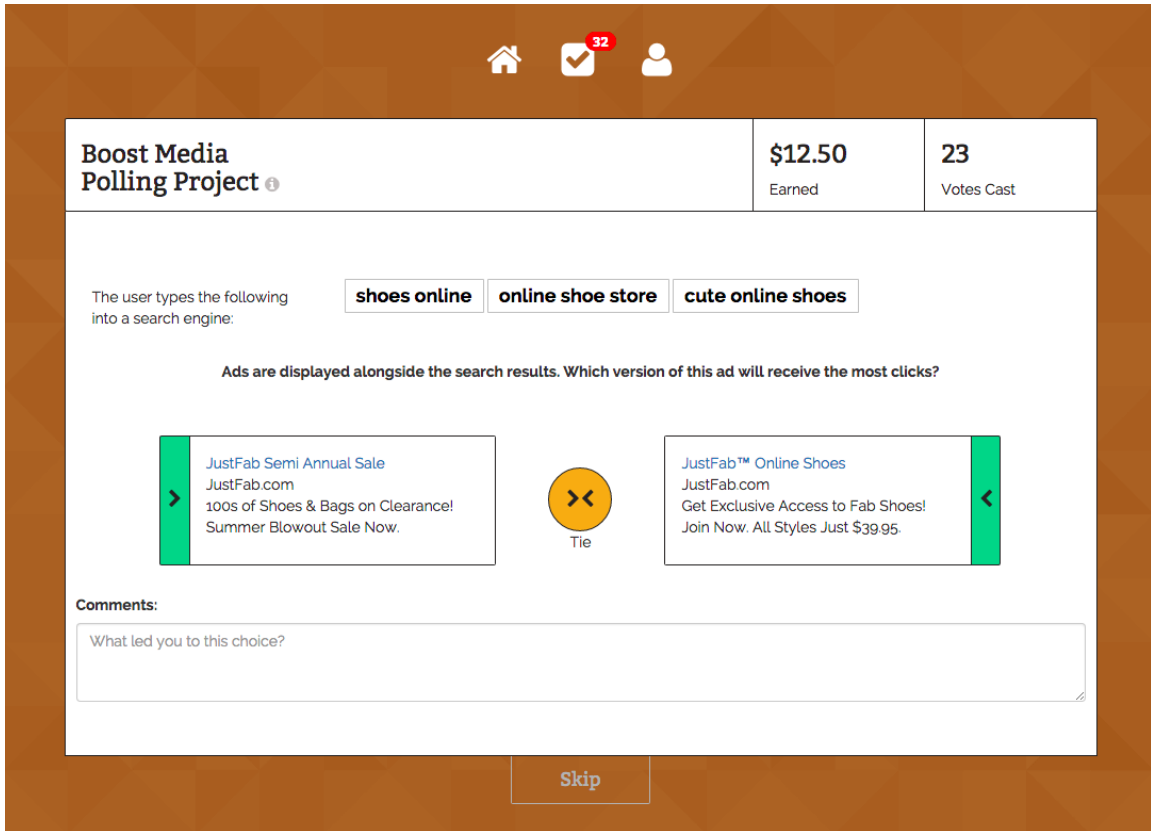


Figure: Vote Page

This is where the Voters express their opinion on a poll by choosing one of the two available options. To enable the Voter to make a more informed decision Pollster provides them with context. The associated search terms are shown for the ads and they are formatted to replicate the look and feel of an online ad.

The image shows a 'Create Poll' form with the following fields:

- Campaign Name:** Enter name
- Poll Type:** Advertisement
- Search Keywords:** Enter Keywords
- First Ad Text:** Enter Ad Text
- First Ad URL:** Enter Display URL
- Second Ad Text:** Enter Ad Text
- Second Ad URL:** Enter Display URL

A 'Create Draft' button is located at the bottom left of the form.

Figure: Create Poll

Pollsters use this dashboard to create polls to collect feedback from Voters. They can pick a reward amount for every vote cast and the total number of votes to complete that poll.

Front-End

Architecture

We believe that properties of product like the load time, responsiveness and 'forgiveness' are core to the experience. Hence, the design process does not end with clicking the close button in Photoshop but, bleeds into the code. We build a Single Page Application using the MEAN stack. There are many advantages of building an application in this way:

- Responsiveness: The website responds to user clicks in micro seconds and behaves more like a desktop application than a website. This is because the entire application is loaded at launch and only small data snippets have to be fetched when the user clicks something.
- Consistent: The app experience is very consistent because only small portions of the page are updated when the user interacts with it.
- Scale: The entire application is loaded when the user first reaches the website and on subsequent user actions and runs only data from the APIs is loaded hence reducing the server overhead associated with serving a page.
- Modular: The application is neatly divided into the front end app and the back end modules. They interact through a RESTful API structure. This makes it easy to further expand the app and support for new platforms like native mobile app.

Libraries and Packages Used:

Languages: JavaScript, HTML, CSS, [LESS](#)

Backend Frameworks: [Node.js](#), [Express.js](#), [Passport.js](#), [GRUNT](#), [MEAN.JS](#)

Frontend Frameworks: [AngularJS](#), [D3.js](#), [Bootstrap](#).

Database: [MongoDB](#)