VOTING ON A MOBILE PLATFORM

BY

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THESIS

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Abstract

Nowadays mobile platform is becoming more and more influential due to the increasing smartphone usage in people's daily life. Conflicting ideas always exist when making a group decision because everyone has his/her own concern/opinion. Since voting is a simple and classic way of reflecting ideas from a group of people, we want to explore social voting behaviors on mobile platforms. By conducting this research study, we hope to unveil how to improve social voting user experience; our focus is on how a change in voting interface affects people's voting behavior. We will provide two interfaces: one is a ranking from negative to positive measures, and the other is a ranking of all positive measures. The recruited groups of people in our study will use these two interfaces to make decisions on group outing to a movie or restaurant. From this one-month study, we figured that people prefer the negative-to-positive measures better than the all-positive measures.

Table of Contents

1. Introduction

The vote system is a time-honored means of gathering individual decisions and aggregating them into a single collective decision. As such, vote systems are the hallmark of democratic governance [5]. Usually a voting system consists of two parts: one is ballot form, and the other is tallying/aggregating method. The ballot form is the personal vote where people express their own opinions. Tallying method determines how to aggregating the results. Common tallying methods include plurality, Borda Count, and approval vote [5]. Plurality is when people only vote for one option, Borda Count is when people generate a ranked preference list, and approval vote is when people can vote for multiple options with equivalent weight on each of the voted option.

There are two major voting systems: majority rule voting system and positional voting system. The details for these two systems are described in the background section. The voting system in our study is a variation of Borda Count, which is a positional voting system. Basically we open up the negative measure in positional voting and enable users to affect others' vote entries by negative voting. We did research on existing voting system and realized almost all the voting research studies are about political elections like [7], and a majority of them like [6, 8] focuses on the security. Research studies on social voting behavior are very rare.

The paper is structured in the following manner: Section 2 discusses about background theory of general voting systems. Section 3 discusses about existing application/interfaces that is similar to Vote2Go. Section 4 discusses the evolving process of our interface design. Section 5 discusses the experiment and analyzes the results. Section 6 concludes the study and poses a potential interesting future work.

2. Background Theory

The goal of a general voting system is that a group of people evaluates a set of alternatives and produces a single group ranking that orders alternatives from best to worst in order to reflects the collective opinion of the group. [1] In order to achieve the goal and design a successful voting system, the most important part is the fairness and trustworthiness. This mostly comes from the underlying model/strategy behind the system. Meanwhile, the system should be easily accessible and highly intuitive [3, 4]. This mostly comes from the interface design.

Generally in a voting system, each individual generates his/her own list of preferences and submit to a central unit for tallying. This preference list, which is counted as a personal vote, represents the user's opinion towards all the alternatives. It also indicates transitivity of preference among the options.

2.1 Majority-Rule

The most common way of tallying all the votes is the majority rule, which is take the alternative that is preferred by a majority of the voters rank it first, placing the other second. [1] With only two alternatives, this works perfectly. However, when there are more than two options in the vote, a very famous Condorcet Paradox can potentially occur and cause incoherence.

Consider the following scenario: a group of three people are trying to decide which kind of flavor of ice cream they should purchase. There are three kinds of flavor: Vanilla, Strawberry, and Chocolate.

Suppose User A has a preference of

Vanilla > Strawberry > Chocolate.

User B has a preference of

Strawberry > Chocolate > Vanilla.

User C has a preference of

Chocolate > Vanilla > Strawberry.

Then using majority rule,

Chocolate > Vanilla (User B and User C)

Vanilla > Strawberry (User A and User C)

Strawberry > Chocolate (User A and User B)

are the three pairs with two votes. However, this violates the transitivity rule because the first and second pairs would imply Chocolate > Strawberry which violates the third aggregated pair.

To avoid this problem, one solution is to eliminate the alternatives one by one to produce a ranked list; usually achieve this alternative elimination in a tournament manner. In this way the transitivity is guaranteed. However, Condorcet Paradox raises a pathological issue. Consider the same scenario described above, a group of people decides to vote on the flavor of ice cream to purchase and they have the same preference as before.

Case 1:

Round 1 - Chocolate vs Vanilla

Chocolate wins and Vanilla gets eliminated since User B and C votes for Chocolate.

Round 2 - Chocolate vs Strawberry

Strawberry wins and becomes the final decision since User A and B votes for Strawberry.

Case 2:

Round 1 - Vanilla vs Strawberry

Vanilla wins and Strawberry gets eliminated since User A and C votes for Vanilla.

Round 2 - Vanilla vs Chocolate

Chocolate wins and becomes the final decision since User B and C votes for Chocolate.

As shown in the above two cases, the outcome is different even though the vote options and voters' preferences stay the same. What's changed is that the opponents of Vanilla in the first round of two votes/tournaments are different. Therefore, the final result of the vote depends on the pathology of the voting process.

2.2 Positional Voting

Positional voting is another common voting system. Being different from building up ranked list with pairwise comparison and majority rule votes aggregation, it produces a group ranking directly from the individual ranking [1]. In this type of system, each alternative receives a weight based on its position in the preference list. For example, in a voter's ranking with k alternatives, the first-ranked alternative receives a weight of k-1, the second-ranked alternative receives a weight of k-2, and etc. Then, the last ranked alternative will receive a weight of zero. Aggregating all the weights assigned to each alternative and ordering the alternatives by the aggregated weights produce the group-ranking list.

Just as majority rule, positional voting also has pathology issue, but the issue only arises when there are more than two alternatives in the vote. Consider the following scenario. A group of five people are deciding which flavor of ice cream to purchase. The alternatives are Chocolate and Vanilla. Three people like Chocolate and the other two like Vanilla. Then, Chocolate wins and becomes the final decision. However, when a third alternative, Strawberry, is introduced, the situation gets interesting. Assume the same three people now has the preference as

Chocolate (2) > Vanilla (1) > Strawberry (0),

and the other two people has the preference as

Vanilla (2) > Strawberry (1) > Chocolate (0).

Based on the positional voting,

Chocolate has $3\times 2+0\times 2=6\ votes$,

Vanilla has $3\times 1+2\times 2=7\ votes$,

and Strawberry has $0\times 3+1\times 2=2\ votes$.

Therefore, Vanilla becomes the final decision of the vote, which is the opposite of the previous vote. The only difference is the introduction of the third alternative. In fact, the third alternative does not affect the comparing process at all because it does not win over Chocolate or Vanilla; three out of five people prefer Chocolate to Strawberry, and all five people prefer Vanilla to Strawberry. The reason for the changing outcome is that the newly introduced alternative shifts the attention/vote away from the winning alternative. This behavior also enables voters the ability to misreport in order to manipulate the voting result if they are aware of the voting environment.

In this study we decide to use positional voting while noticing the potential misreport behavior. The reason is that this behavior can also be interpreted as compromising in the context of social voting. The newly introduced alternative can become the choice that everyone accepts if the vote becomes a tie. Consider the same scenario but with only four people. Two of them have preference as

Chocolate (2) > Strawberry (1) > Vanilla (0),

and the other two have the preference as

Vanilla (2) > Strawberry (1) > Chocolate (0).

In this case,

Chocolate has $2 \times 2 + 0 \times 2 = 4\ votes$,

Strawberry has $2 \times 1 + 2 \times 1 = 4\ votes$,

and Vanilla has $2 \times 2 + 0 \times 2 = 4\ votes$.

In this case, the vote is tie and Strawberry is the compromising decision to make.

3. Related Work

As discussed in the introduction, rare research studies have been conducted in social voting, but many mobile applications are developed. We briefly examined voting interfaces on Facebook, iOS, and Android.

As the most popular social network sites on the Internet, Facebook certainly supports voting for decision making (See figure below). Considering the massive amounts of users, Facebook's event voting system is highly accessible; every Facebook user can use this feature. The bar chart visualization is readable and concise. Each option bar has its voters displayed in thumbnails on the right. On the right end of the bar a number displayed indicating the actual count of all the votes. When creating the vote, the proposer can choose to make it a single selection vote or multiple selection vote. (See Figure 1)

PicknPoll (http://www.picknpoll.com) is an Android social voting application. Similar to Facebook's voting interface, it is highly accessible since a proposer can share the vote via major social networks services like WhatsApp, Facebook, LINE and WeChat. It even supports SMS, which makes the installation of the application not necessary any more (if the voter does not intend to create votes). The voting action is highly intuitive as well. On the SMS voting interface, a voter is sent links to each voting option; clicking the link will cast the voter's vote towards that option. For visualization, PicknPoll also uses a bar chart. (See Figure 2, 3, 4)

Decision Buddy Decision Maker (http://www.decisionbuddyapp.com) is another social voting application on Android platform. It integrates the two voting systems described in the background section. As shown in the figure below, each voter takes turns to vote by performing a list of pair-wise comparisons. When tallying the votes, the system applies positional voting; it assigns weight to the ranked list that is not visible to the user, and aggregates the weights of each option. In the end, it will display the winning option of the vote and the aggregation results. No visualization is used, and the voting is kept anonymously. (See Figure 5, 6, 7, 8)

Chooser, an iOS application, is probably the work that is closest to Vote2Go. It applies positional voting to the interface; each voter dragging on the scale bar to cast his/her weight of vote towards each option in the vote. The voter is also able to cast a veto that indicates the negative opinion. When tallying the votes, the system simply aggregates the available weights on each option and displays the aggregation results in a similar interface as the interface for casting votes. (See Figure 9, 10)

4. Interface Design Evolution

Our initial interface design was a circle with venues located on the perimeter. The voters cast their votes by dragging an arrow from the center of the circle to that a venue on the perimeter. The length of the arrow indicates the level of preference or simply weight the users decide to put on that particular venue. This interface is visually pleasing, also the drag-and-drop behavior is very intuitive. Meanwhile, implementation for multiple venues (say n items) becomes trivial: each venue has an area of n2 radiant and we place the name of each venue on the arc of the circle corresponding to each area. After each vote ends, all voters are able to view the weight cast by other people towards each venue. (See Figure 11, 12)

From there we did our first initialization, most users were able to perform the voting actions as expected. However, one of the test users brought up an interesting point. In her response, she did drag an arrow from the center to a venue, but in a reverse direction. Her explanation was that she really disliked that venue due to the poor service provided during her last visit. This caught our attention and triggered our rethinking of our interface design.

The first thought is that taking in negative opinions into consideration when aggregating vote outcomes is actually very interesting. Negative voting enables users to affect others' vote entry, giving more control of the voting outcome to the users. When we decided that negative voting was going to be our primary goal of the study, a confusion problem of our circle-based interface emerges. The confusion occurs when voters are viewing other people's vote weight distribution. This circle-based interface design was able to support multiple venues fluidly. However, it did not support negative opinions too well due to the potential introduction of weight confusion towards venues. When a voter decided to show a negative opinion upon a venue, the intuition is to drag an arrow from the center of the circle to that venue in a reverse direction. This is where confusion could happen to the user. Consider a vote with two venues, let's say A and B. Based on our interface design method, we would have the two venues located opposite to each other. When casting negative weight on venue A, the user will drag an arrow from the center to the opposite direction of venue A, which is the direction of venue B. Let's assume the same voter cast a negative weight 3 to venue B and the negative weight the voter cast to venue A is 4. Then the outcome of this vote from this user looks like Figure 13.

In this case the interpretation would be this voter cast a weight of 3 to venue A and 4 to venue B, which is the opposite of the voter's intention. An easy fix is to use different color to distinguish between negative and positive weights. But in this both-negative case, the intuition persists and the situation won't improve much.

Consider another case in this scenario. A voter casts the same negative weight 4 to venue A and a positive weight 3 on venue B. The outcome of this vote from this user looks like Figure 14.

In this case the interpretation the two weights are visually overlapped. Therefore, it looks like the user cast a weight of 4 on venue B and nothing on venue A, which is inaccurate and misleading again. To solve this problem, we can either change the visualization or simply redesign the voting interface. The former option would most likely create this inconsistency in the user experience.

Figure 15 is our modified final version of the interface design. We modified the way a user casts weight and also changed the circle-designed visualization accordingly.

After the modification, the user taps a block on a likert scale to cast the weight for a venue. Originally in the circle-based design, we were using drag and drop to draw an arrow for weight casting. Both interaction approaches are user-friendly and highly intuitive. However, tapping blocks provides a more accurate counting. Meanwhile, tapping is an easier action than drag and drop. Also, using one dimensional likert scale remove the dependency of venue position in the circle-design, which indeed removes the confusion problem described in the previous section. We choose the traditional fifth likert scale because the oddness can provide users with a neutral opinion option [2]. To compare the impact of the scale range, we can simply change the number of the likert. For visualization of the vote, we changed into a bar chart; we realized that the most interesting part of the visualization should be the amount of vote weights is cast to every venue. Therefore, simply show the quantity difference, which is what bar chart is good at, should be sufficient for this study. (See Figure 16, 17)

We choose to implement this voting interfaces as a web application since nowadays all the smartphones supports HTML and Javascript. Therefore, our voting interface will have no mobile platform limitation. This is important because recruting with groups of people is difficult already. We want to minimize the device restriction as much as possible to get more people to our study. The first revision was implemented with Bootstrap, which is a well-known CSS framework that has nice responsive support. However, it is designed for desktop web application. Many controls are not mobile friendly. So we moved to jQuery mobile. Our visualization is implemented by using Google Chart APIs. The backend are prototyped in PHP because of the native support with MySQL, which is our database hosting provided by college of engineering.

5. Experiments

We recruited two groups of people. Each group consisted of three people. All of them were over 18 years old. They all had access to smartphones and knew how to operate the mobile web browsers. Each group went out quite frequently, on average two to three times a week.

For each group, a participant used the mobile web application, Vote2Go, to create new instances for a movie or meal. The initiator provided a selection of several venues that the group then voted upon. Each invited person that formed the group voted using the assigned interface, either all positive range or negative range included. At the end of voting period, a voting result was shown to every voter. At the termination of each voted event, we sent out an email if the participants in fact attended the voted venue. At the end of the second week, we swapped the two interfaces assigned so that each group experienced with both interfaces. At the end of the fourth week, we sent out a survey to all the participants to fill out.

In the post-event questionnaire we asked whether a participant went to the winning venue in the vote. If the group ended up going to the winning venue, then the participants are required to rate his/her satisfaction score. Otherwise, the participants are required to briefly explain the reason and the alternative venue they went. In total 23 votes happened during the study for both interfaces and both groups. 12 votes happened in all-positive-range interface and participants went to 10 out of 12 venues selected via the interface. 11 votes happened in negative-range-included interface and participants went to 8 out of 11 venues selected via the interface. The average satisfaction score of all-positive-range interface is 3.40, and that of negative-range-included interface is 4.46. For instances where the satisfaction score is not available, people were not using the application to vote for a restaurant or a movie; instead, people were asking opinions such as laptop or barbershop or dish cooking selection.

In the post-study survey we asked people's satisfaction score towards the voting system, easiness of use, preference between the experimented interfaces, and several opinion questions. The average satisfaction score of the system is 4.16, on a scale of one to five where one means least satisfied and five means most satisfied. This indicates that Vote2Go is able to provide relatively satisfactory results to the users. The average ease of using score is 2.33, on a scale of one to five where one means easiest to use and five means hardest to use. This suggests that we need to further improve the usability of the interface. Four out of six people prefer the negative-range-included interface to all-positive-range interface. Here are some comments from these people:

"[Negative-range-included interface] makes me able to show disagreement."

"I like how I can affect other people's score [ballot votes]."

"Never seen this [Negative-range-included interface] before; looks cool."

Apparently these people seem to like the idea of showing disagreement. From another perspective, this is similar to a "Dislike" button on Facebook except in a different context. The rest two people said they did not think that negative range was too useful or intuitive; they would simply vote the maximum weight for their desired venue and leave everything else default. Besides, one person wrote, *"Rating seems more user-friendly."* All-positive-range interface is like a rating likert. Since rating likert has been used everywhere, it is reasonable that some people think it is more intuitive and user-friendly.

In the opinion questions, people liked and showed appreciation of the clearness of the bar charts and the user-friendly interface design. For the most wanted features someone mentioned an online chatting system to communicate with each other while making the voting decision. For improvement, someone pointed out that adding the contacts before the voting process was time-consuming and not very intuitive; they had to type in email, which sometimes was not easy to remember, in order to add contacts. They would also like to add venues after a vote has been created; in this way everyone is able to contribute ideas of venues.

Some people thought that Vote2Go suggested good eating venues because of the quickness. One person had an opposite argument because he/she rarely had what he/she wanted. For suggesting movies, one person mentioned that further explanation of each movie is needed because not all movies suggested by the initiator were familiar to him/her.

6. Conclusion

In this study we proposed a positional voting system with an interface of negation elements included. We explored how a change in the voting interface can affect people’s voting behavior in a social voting system, specifically, whether the interface supports negative opinion showing. The experiment shows that people prefer this interface that they can affect others’ votes to a regular voting interface.

From the experiment analysis, we noticed that one participant mentioned that he/she did not really enjoy the system because sometimes he/she could not get his/her intended venue. To solve this problem, we could incorporate a vote currency to the existing system: basically giving user the ability to express his/her desired level. How this change would affect people’s behavior in a voting system like Vote2Go is another interesting topic.

7. Figures

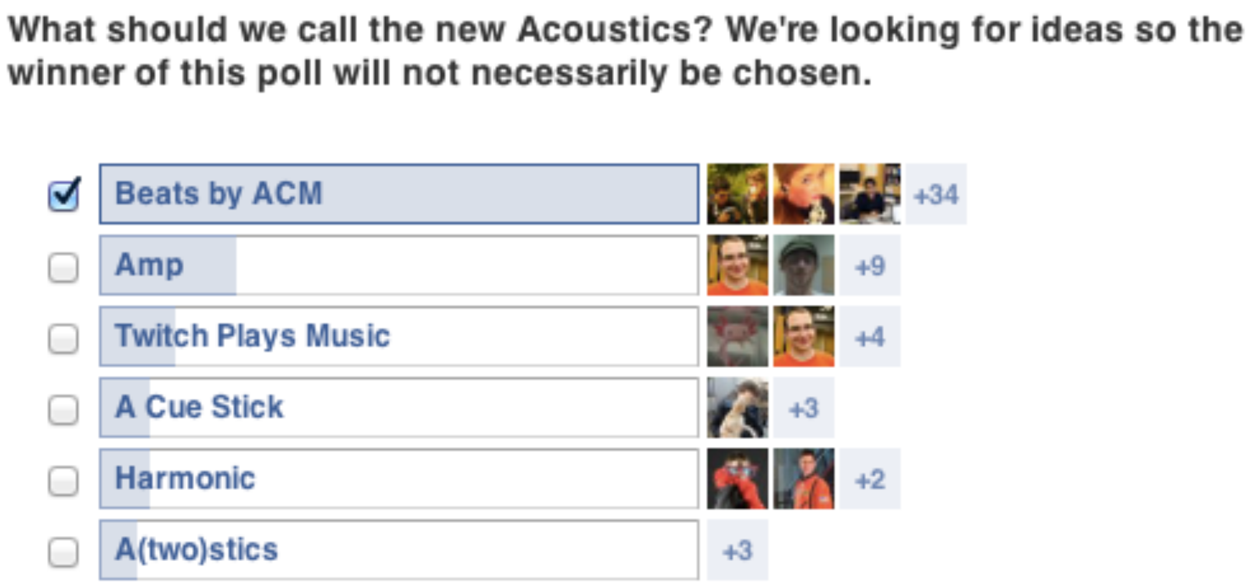


Figure 1

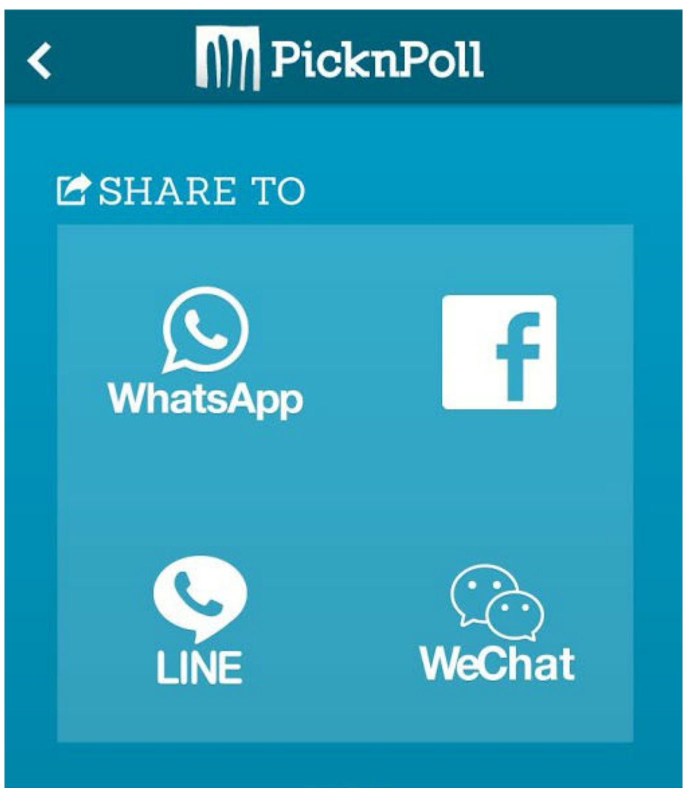
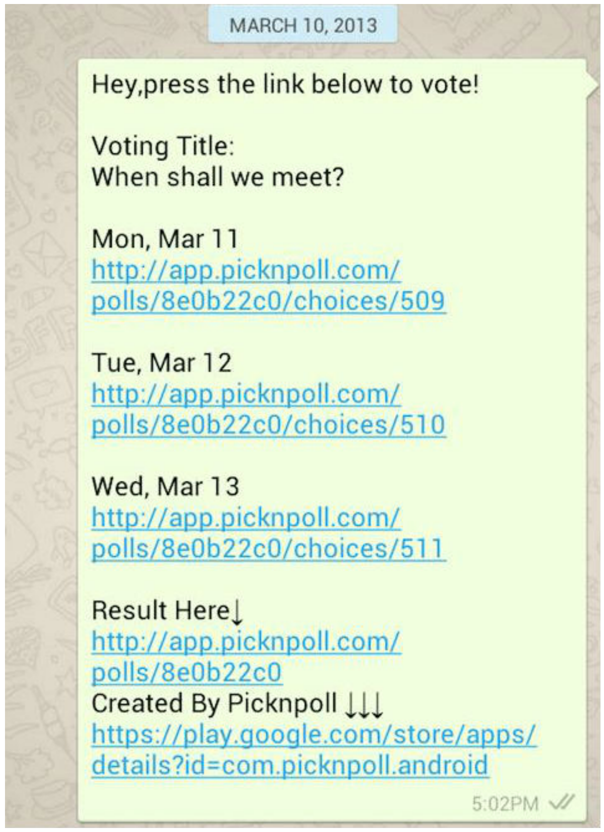


Figure 2



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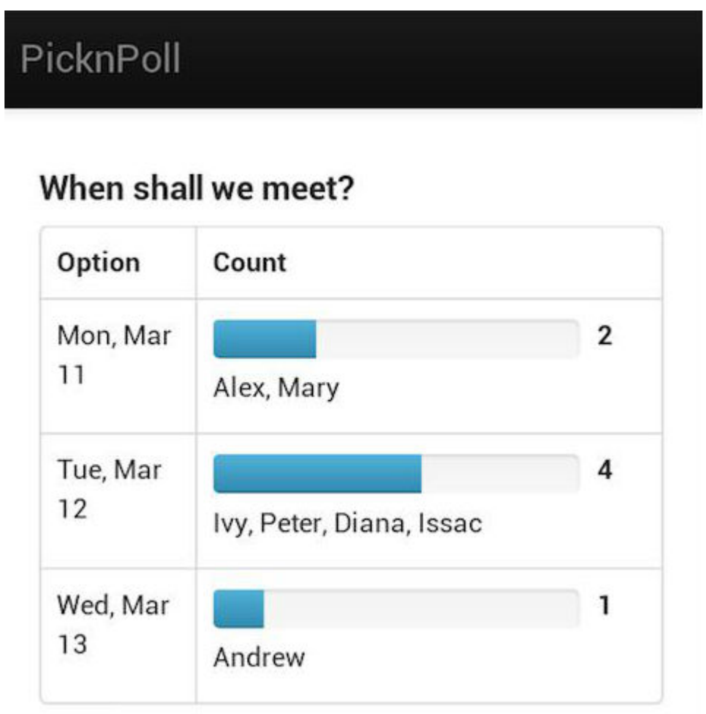

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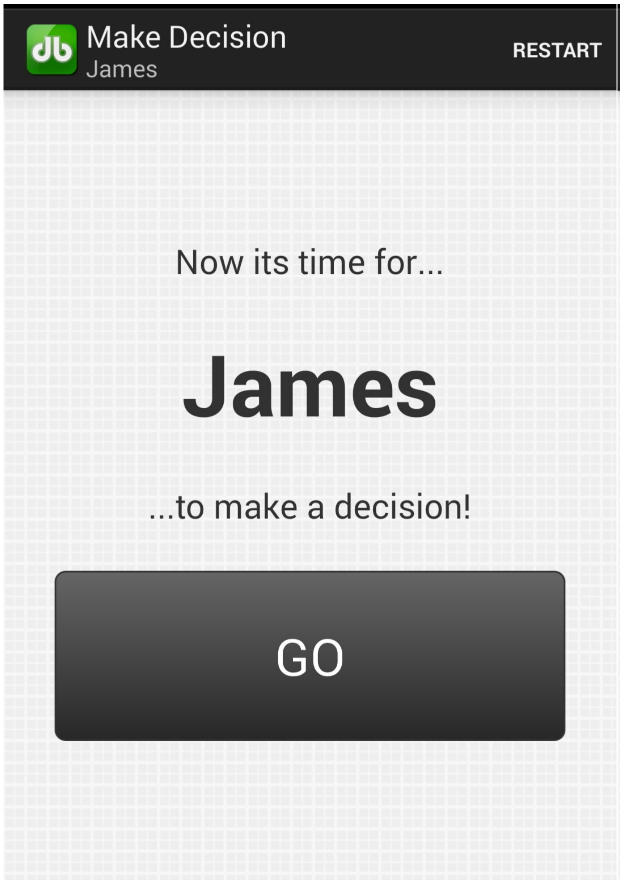


Figure 5

Figure 6

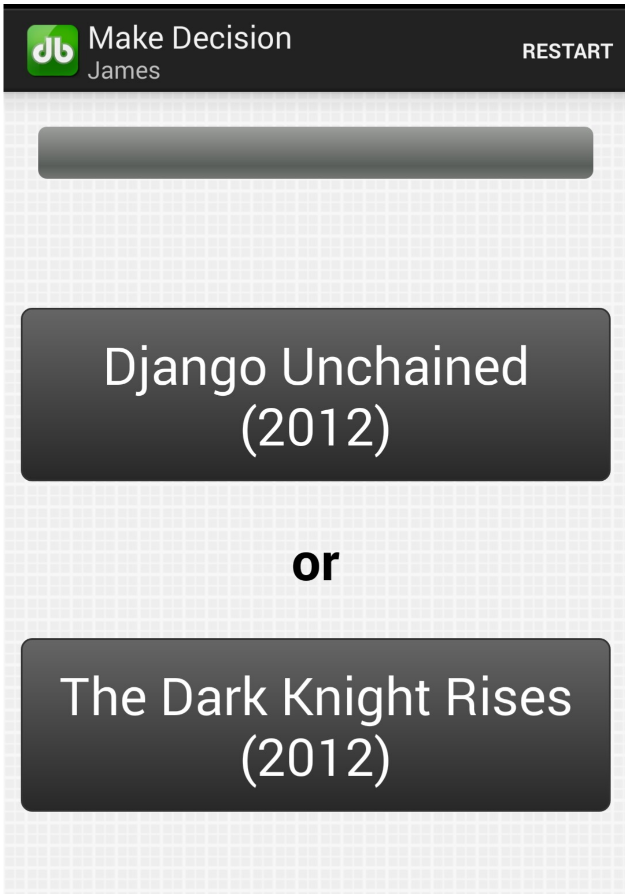


Figure 7

Figure 8

Figure 9

Figure 10

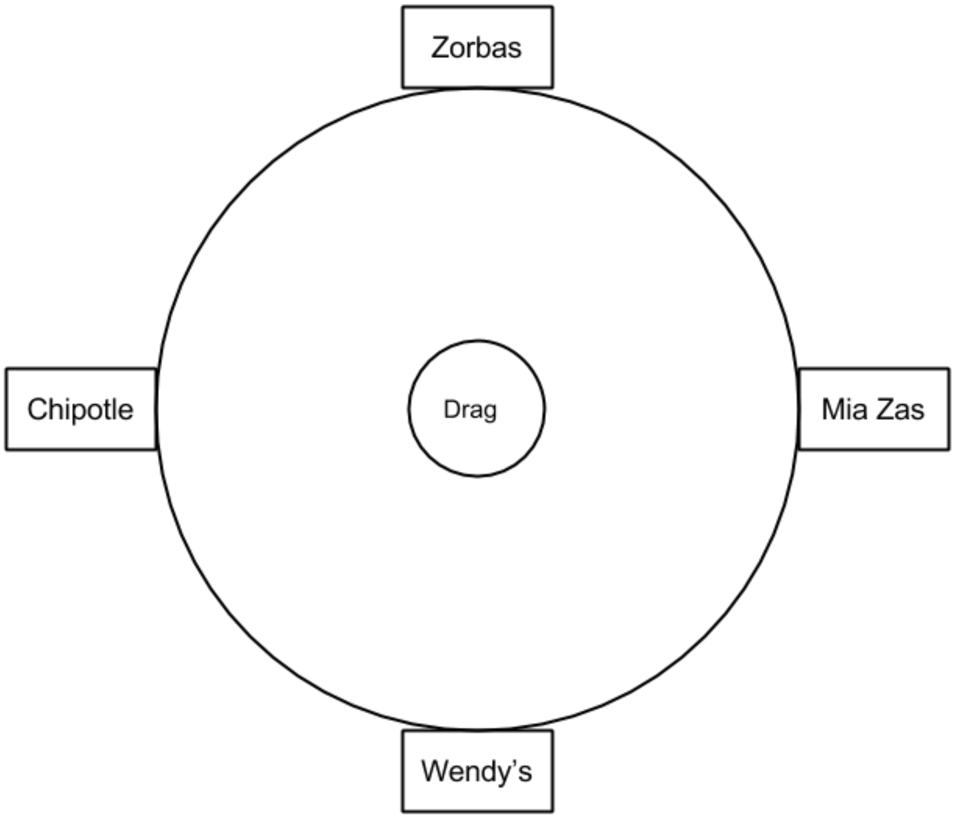


Figure 11

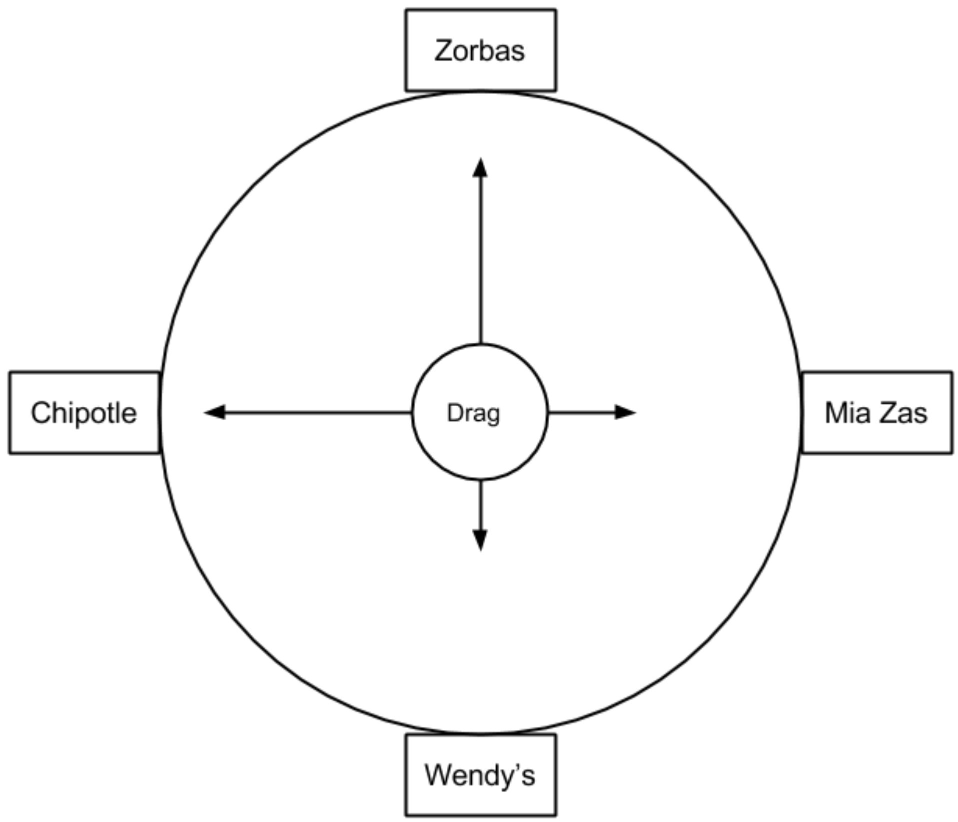


Figure 12

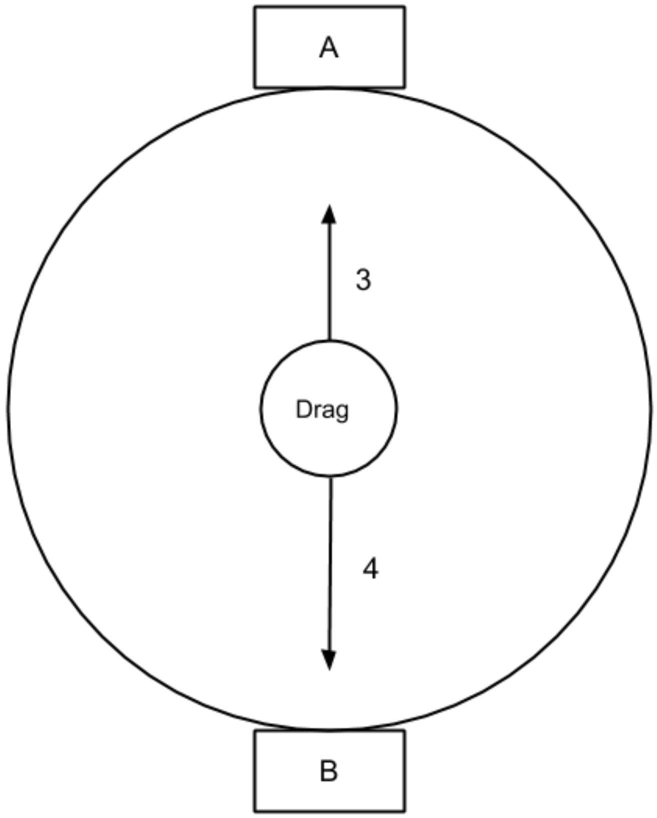


Figure 13

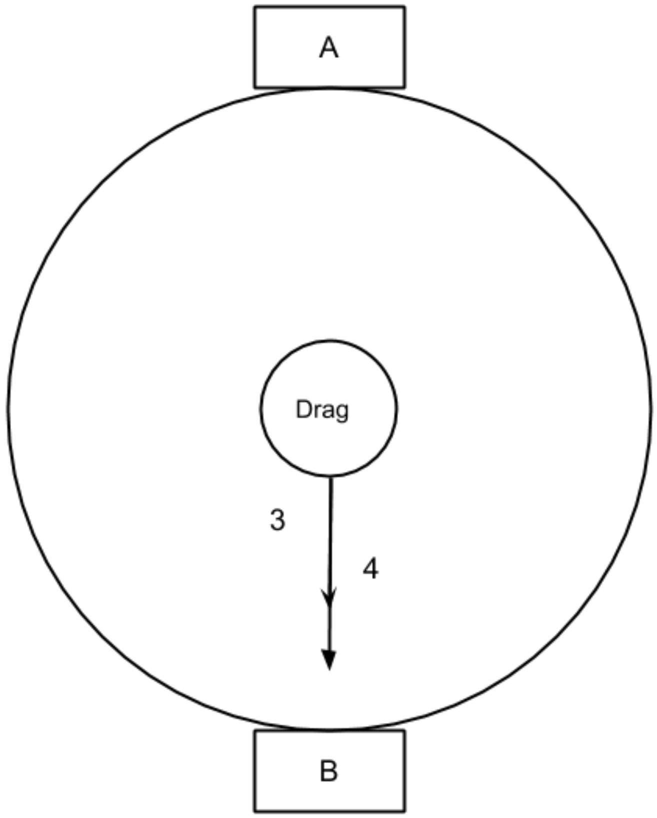
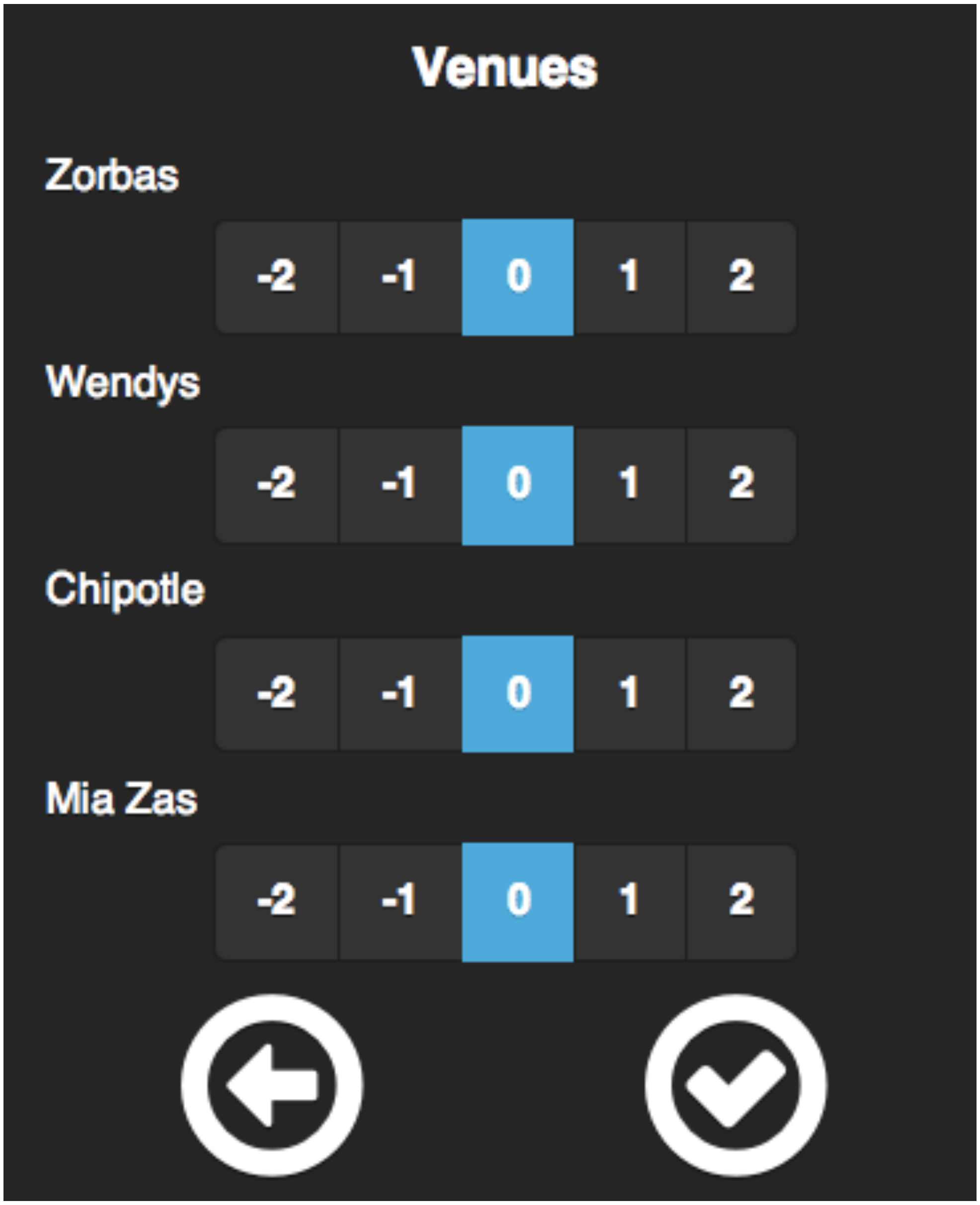


Figure 14


Venues
Zorbas
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Wendys
-2 -1 0 1 2
Chipotle
-2 -1 0 1 2
Mia Zas
-2 -1 0 1 2

Figure 15

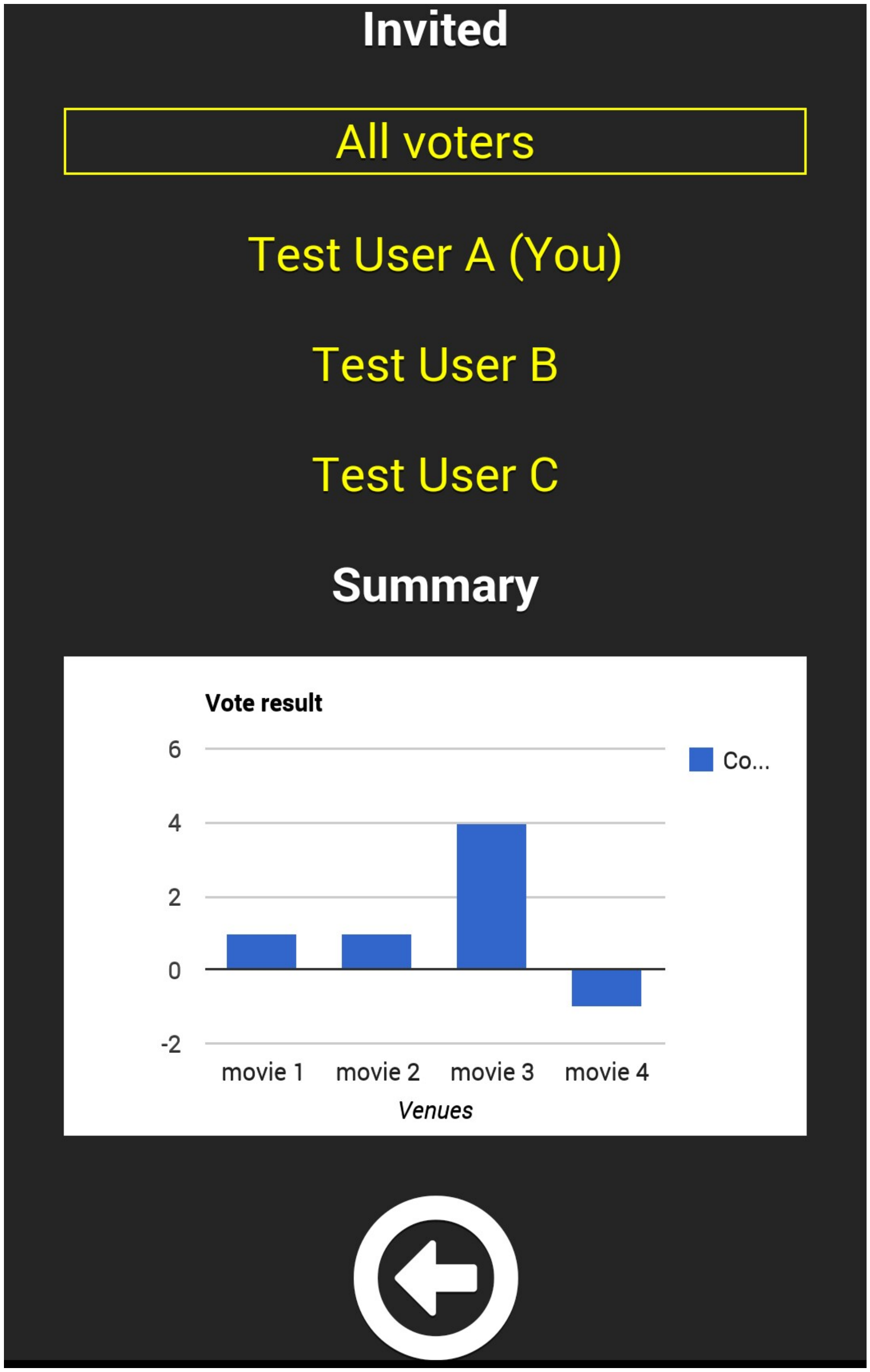
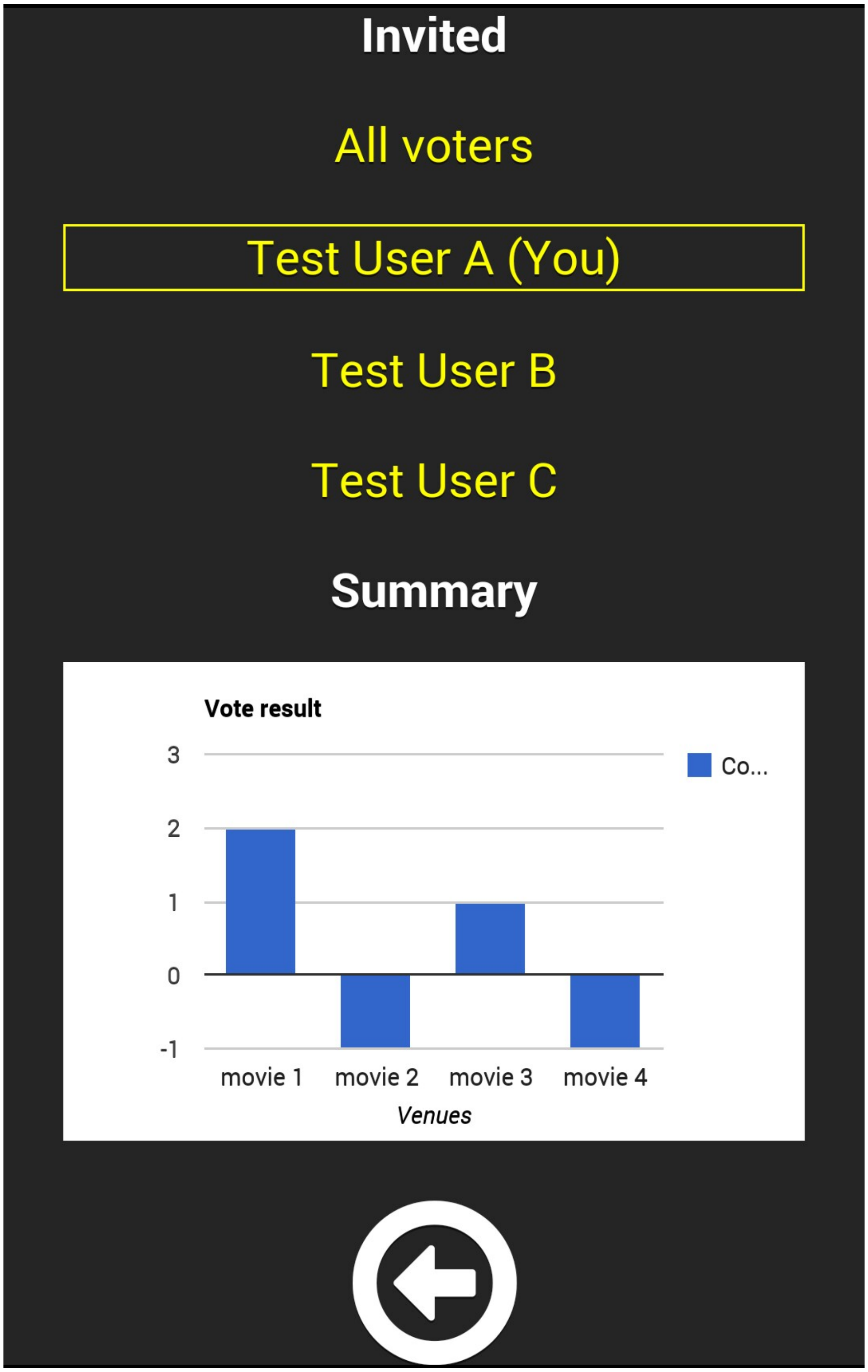

Invited
All voters
Test User A (You)
Test User B
Test User C
Summary
Vote result
6
4
2
0
-2
Co...
movie 1
movie 2
movie 3
movie 4
Venues

Figure 16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3
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Venues

Figure 17

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