Dota2 Playstyle Visualization

Processbook

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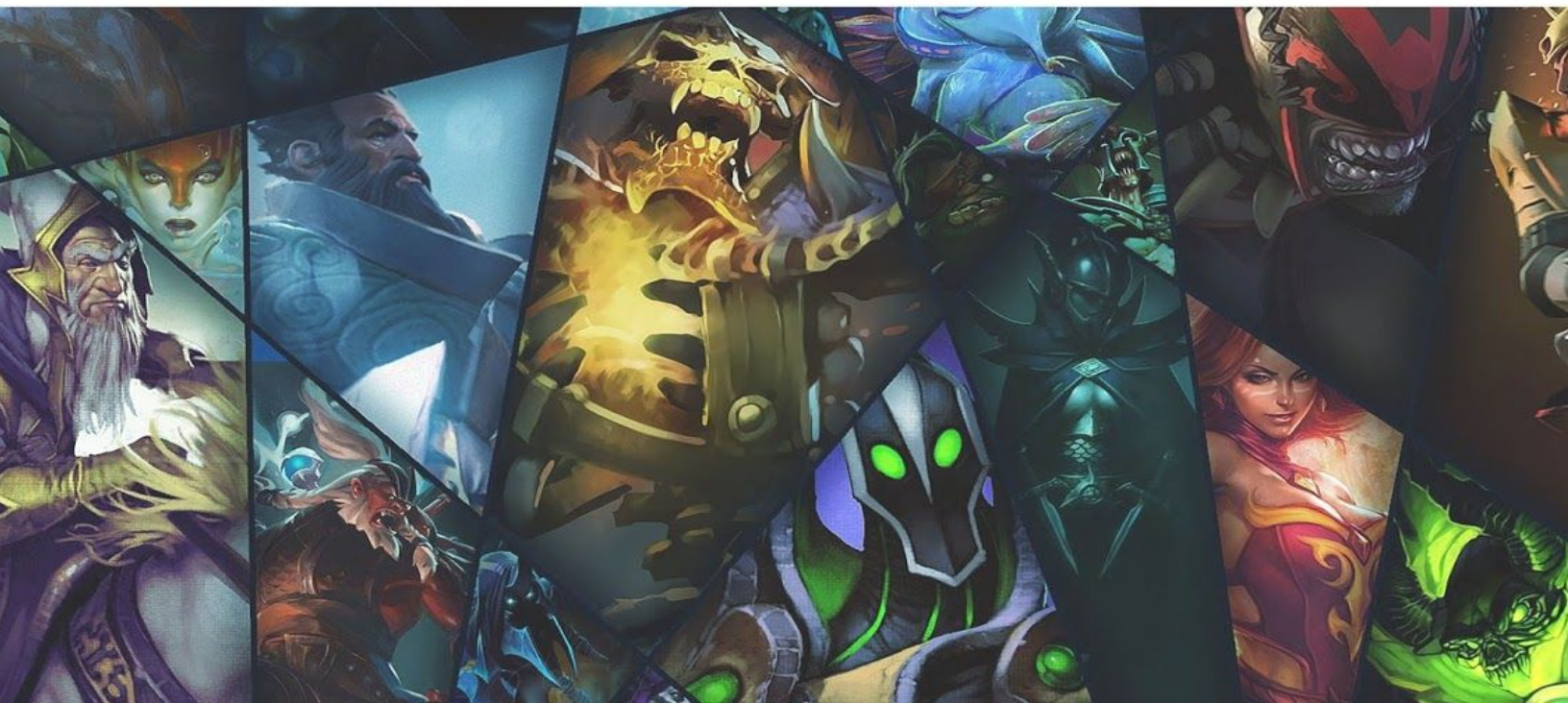
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Kuang Xiong, Tengyang Jia

1 . Overview and motivation

Dota 2 is a free-to-play multiplayer online battle arena (MOBA) video game developed and published by Valve Corporation for Microsoft Windows, OS X, and Linux. The game is the stand-alone sequel to Defense of the Ancients (DotA), which was a community-created mod for Warcraft III: Reign of Chaos and its expansion pack, The Frozen Throne. Dota 2 is played in matches between two teams that consist of five players, with both teams occupying their own separate base on the map. Each of the ten players independently control a powerful character, known as a "hero", that all feature unique abilities and different styles of play. During a match, a player and their team collects experience points and items for their heroes in order to push through the opposing team's defenses. A team wins by being the first to destroy a large structure located in the opposing team's base, called the "Ancient".

Today, more and more people realized the importance of big data analysis for sports. You can get more familiar with your opponents from the data and help you choose a better strategy to win the match. This is particular true for Esports because everything about Esports are running on computer and we can easily get the data which is useful for us. Today's Esports is not only a game of five person sitting together and fighting to win the match. It is also related to data. But when we get the data, how to visualise it becomes a good question. If we can do a better data visualization of the data, we can get more useful information and improve our performance in the game.

Although there are some secondary analysis website which can give player a visualisation of their match history. For example, DotaMax, a statistic website, which provide some summary statistics for each player for recent 100 games, information of individual matches. However, we want to implement a site to explore a player's entire history, get information about a player's play style and habits, and see what he can improve in the future.

Figure 1: Dota2 map. The Radient and The Dire take one side of the map each. The goal of the player is to destroy their opponent's base.

2. Related work

Currently there are many Dota2 statistic websites. DotaMax and DotaBuff have great match visualisations to see the detail information of an individual match. They even have a few summary statistics. They have done a excellent job on single match visualisation. We can almost get anything we need to know about a specific match from these sites. However, rather than use some visualisation to show individual statistics, they used simple tables to show the heroes a player has played and the items a player bought. Also, even though we can get detail information for a given game, we can not compare the player's performance on this game to other games. Those are the places where we want to make a improvement.
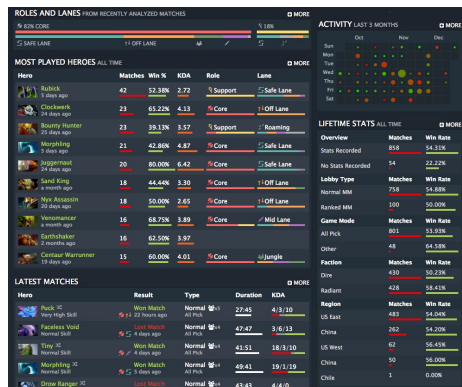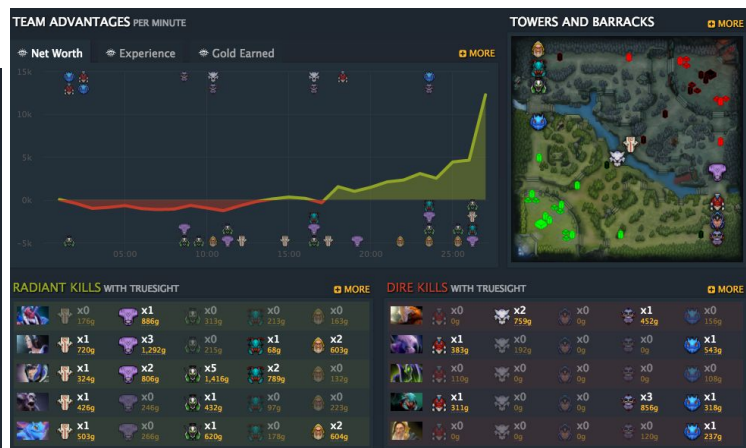

Figure 2 Simple table in Dotabuff

Figure 3 Great match detail in Dotabuff

3. Questions we are trying to answer

How can I measure my performance in a single game?
How can I see what kind of heroes I played the most?
How can I tell which hero I play best?

4. Data

The data we are visualizing is the match history of a given player. To get this data, we used the Valve Dota2 API to get a user's data. At first, we are trying to implement a real time website that can dynamically get data from the API and update the sites. However, as the Valve requested we only make approximately one API call per second, and the feedback of the call may take even longer time. Also, we tried to store our information in a database and we only make a call when we need to update the database. However, it's also difficult. In the end, we used the API and get match history of 5 user(also, we ended up only being able to gather 500 matches for any user) and save that in JSON file for use.

We also gathered a lot of supplement data and images for the display. The Dota2 Web API returns data in the form of JSON object. We need to map the 'id' and 'names' of the heroes or items in the JSON file to some actual information and images and display those in our visualisations.

5. Exploratory Data Analysis

We started from the heroes visualisation. Instead of listing all the heroes in a table, we decide to use a histogram to show all heroes and the number of games a player has played. However, we found that a bar chart might not be a good way to show hero play. Since we have only 500 matches history for a single player, many heroes are played only 1 or even 0 times. This makes it so hard to see them in the histogram. Thus, we decide to find alternative design. Finally, we decide to use the sunburst chart, which was useful because arcs are less sensitive than length and we can zoom in to see the small values. Also, the heroes can be divided into three categories, they are strength heroes, agility heroes and intelligence heroes. We can easily visualize the category if we use the sunburst.

For the items visualisation, we have thought some other chart such as donut chart, but we finally decide to use the histogram. Even though the connections between each items are weak, we can find several different ways to sort these items. We can sort them by the times the player purchased, by the cost and by the name of the item. By sorting the purchased items in these ways, we can easily find the player's preference on items.

For the gold per minutes(GPM) and experience per minutes(XPM) visualisation, we at first used a curve chart to show the GPM/XPM trend. However, we found that the GPM/XPM of different heroes and positions may have huge difference, so we need some new visualisation to show more information. Later, we use a scatter plot to show the GPM and XPM. However, the initial scatter

plot(GPM vs. XPM) means nothing. We can not compare performance from game to game. We tried to color different heroes and find it looks messy, as there are more than 100 heroes. Finally, we decided to keep the scatter design, but we used the average GPM/XPM as the x axis. This allows the player to compare their performance to their average play on that hero, which is more useful and meaningful than previous design.
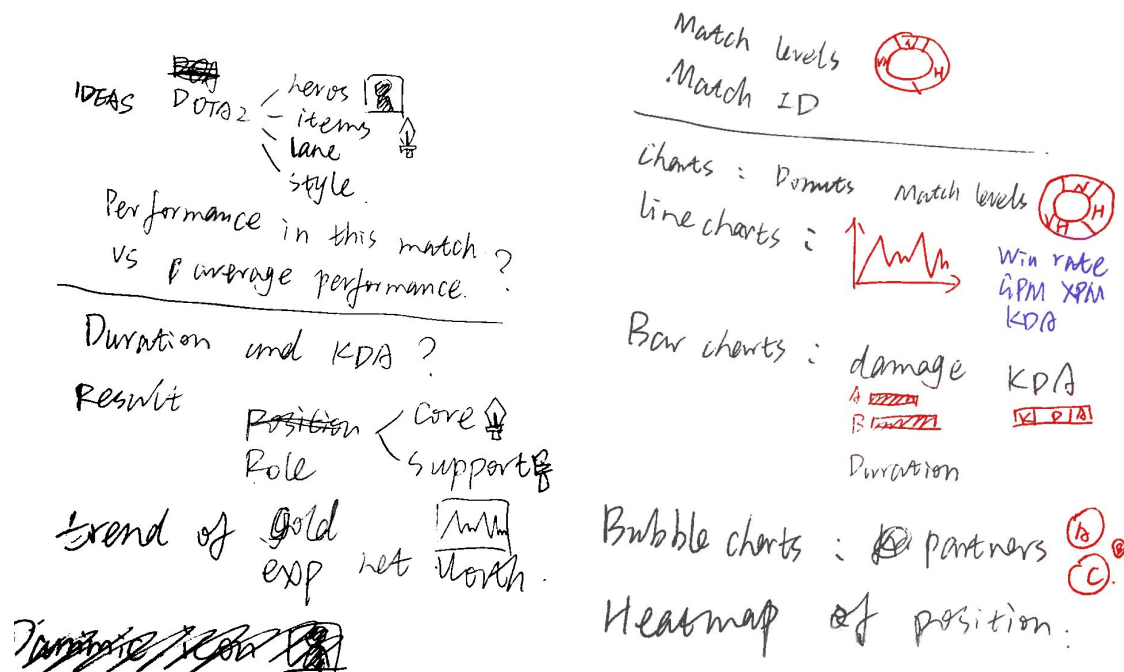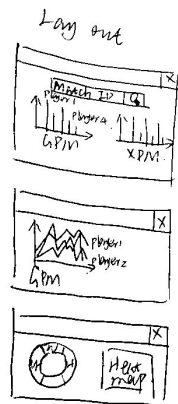
6. Design evolution

6.1 Initial design: submitted with project proposal

Figure 4, brain storm result. We decide to use donut chart to show the game level, use curve chart to show the win rate / GPM /XPM, and bar chart to show the Kill /Death/ Assist.

Figure 5. layout design

Figure 6. Use table to visualize the heroes and items as DotaMax and DotaBuff do.
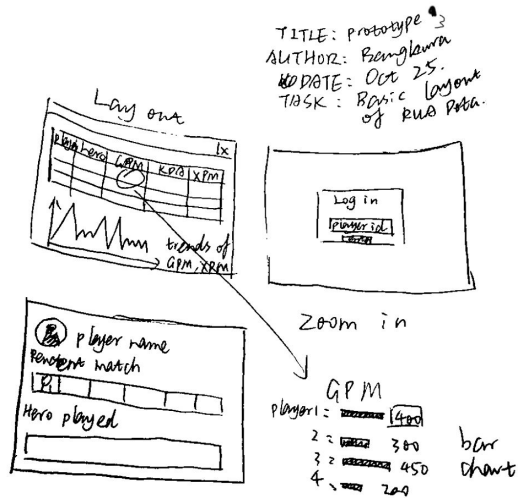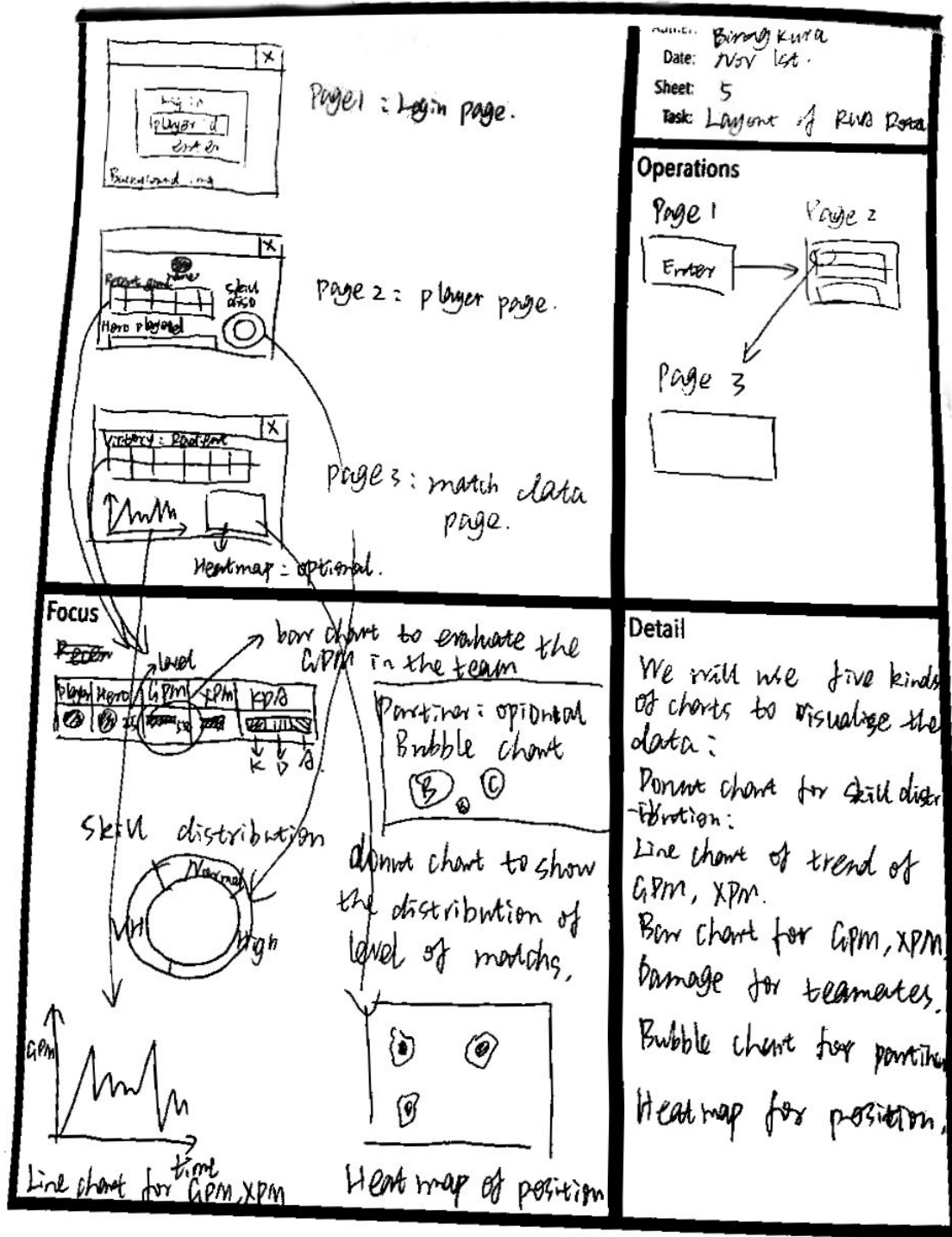
Figure 7. Use table to visualize

Figure 8. Here are our final result of the initial design.

6.2 Trend view design

The best way to show the trend of win-loss rate and XPM/GPM is line graph. However, if we put 3 line charts in our page, it would be a little bit boring. So we combined the XPM/GPM trend view together(We can't put the win rate view in the same graph because of the y-axis range).
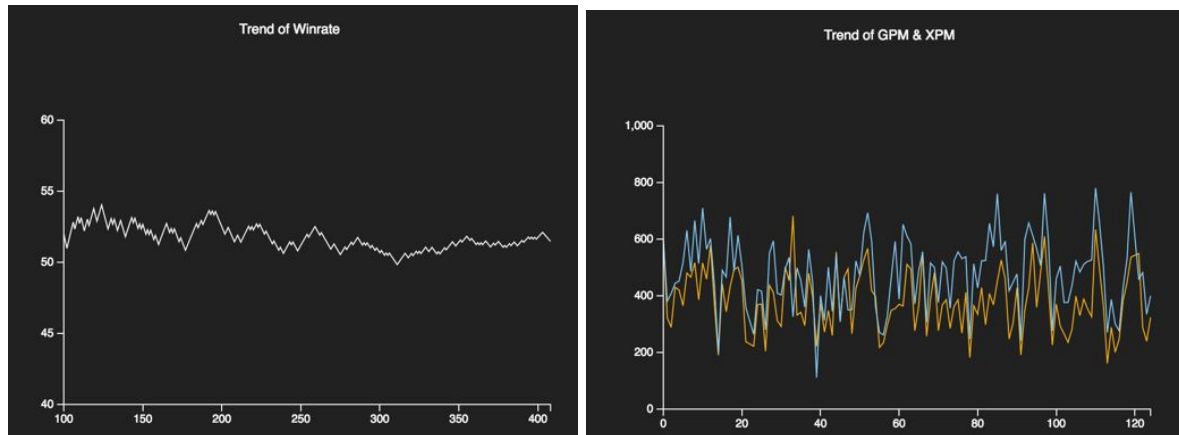
Considering there might have many different use case, we decide to add a switch function to the XPM/GPM view. So we added a click action to this part of view. When we click on any part of the trend div, the XPM/GPM chart will switch from 3 states: only XPM, only GPM, and XPM/GPM together.

6.3 The hero played visualisation design
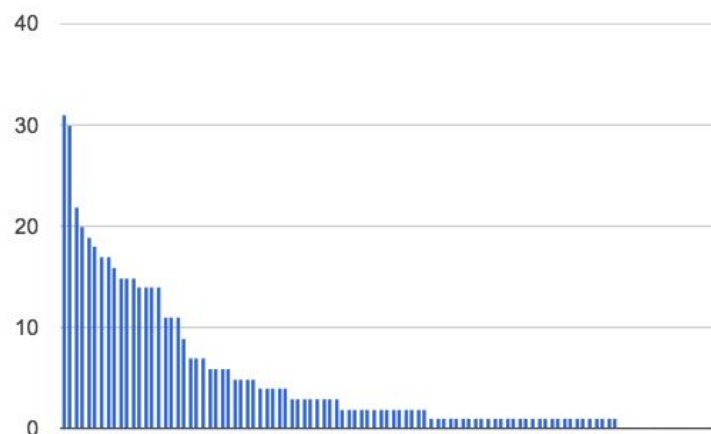
We started the design like this:

Figure 9. Histogram of hero play

Pros: easy to understand, the length represents the times a hero played.
Cons: 1. There are many heros played only 1 time or 0 time.
        2. No interaction

3. Can not reveal the types of hero
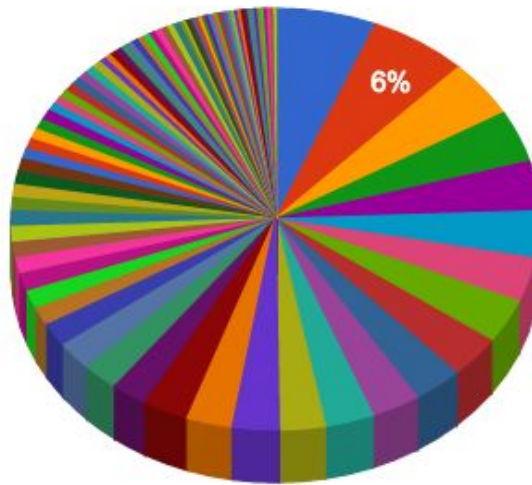

Figure 10. Pie chart of hero played.

Pros: easy to understand
Cons: 1. Too much tiny slices, hard to see
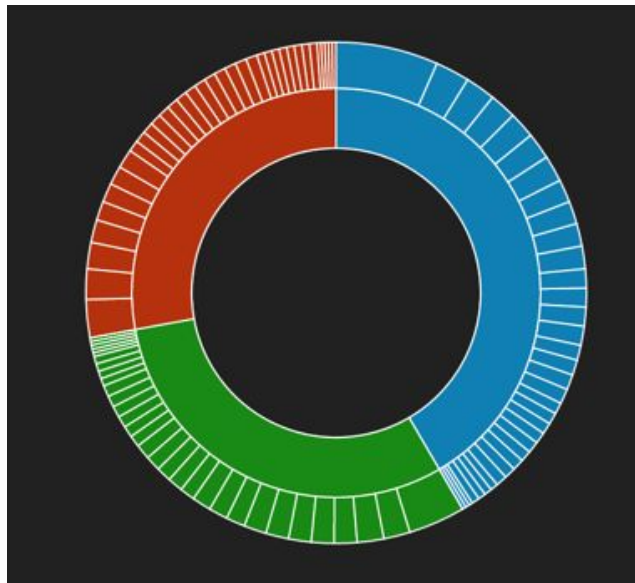   2. No interaction
       3. Too many colors.

Figure 11. Final design: zoomable sunburst

Thanks to the implementation of Kerry Rodden:
https://bl.ocks.org/kerryrodden/477c1bfb081b783f80ad
And John Stasko: http://johan.github.io/d3/ex/sunburst.html
Pros: 1. Can zoom in/out to show detail information
         2. Easy to find categories
         3. Interactive
         4. Small slice become less of concern

We decide to added tooltip to the chart, so we can get more information in the tooltip. The user can see the hero's name, image, the items purchased the most.
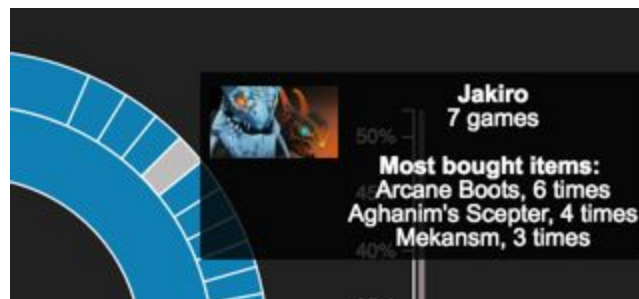

Figure 12. Hero play chart with tooltip

6.4 Items Visualisation

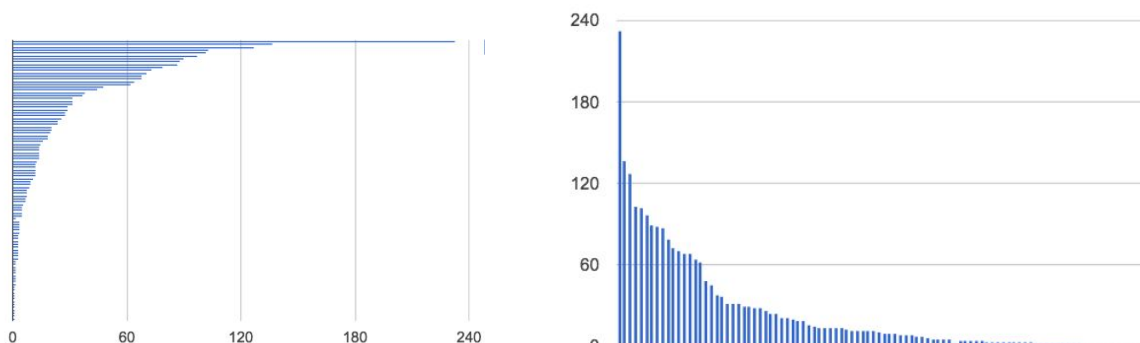Figure 13. Initial design for items purchased. Number of times encoded into length of bar.

1. Easy to find the preference on the items.
2. It would be better if we can sort the items by different parameters. So we decide to add some options to sort the bar in different ways.
3. Sorting bar by number of times the item purchased
4. Sorting the bars by the name of the item, in alphabetical order. So user can find the item by name.

5. Sorting by cost of the item. So we can find if a player prefer some item that have high performance cost ratio.

Also, we found that we can use the color of the bar to represent the win rate. Use a win/loss color scale to represent the win rate of an item. From this we can find what items can help a player win. Also we can get some new information. For example, we may find a player have a great possibility to win in a game that the player bought some expensive items.
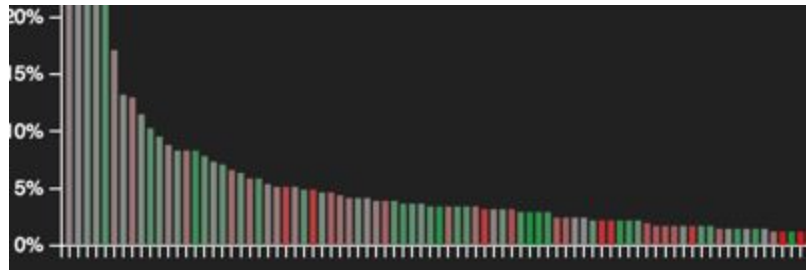

Figure 14. Color the bar with win rate.

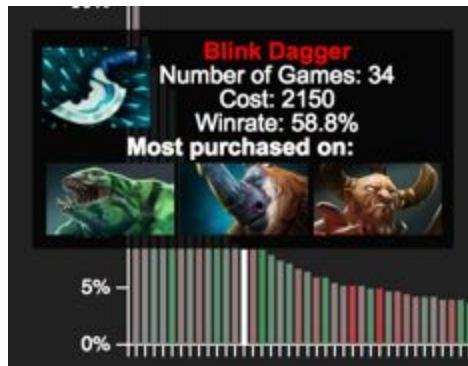We added tooltips for item to show the item picture, the cost and the number of times purchased.

Figure 15. Added tooltip to the item visualisation

6.5 The XPM/GPM design

As we described in section 6.2, we used a line chart to show the trend GPM/XPM. However this is not enough to visualize the XPM/GPM information since they are important metric to evaluate a player's performance in game. So we need more visualisations on XPM/GPM.

Figure 16. Trend of XPM/GPM

Pros: Easy to understand
Cons: 1. different hero and positions may have huge difference
        2. Can not compare user performance from match to match

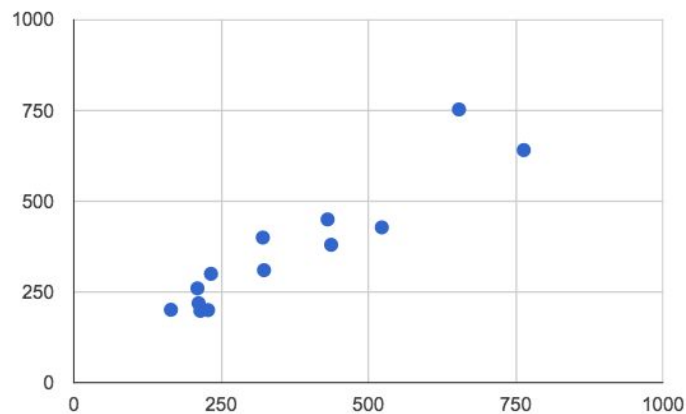Later, we consider to draw a scatter plot of GPM vs. XPM

Figure 17. Initial scatter plot of XPM/GPM

This chart means nothing.
If we color different hero, the chart will look messy because there are more than 100 hero in Dota.

Finally, we use the average value as the X-axis. This enable us to compare a player's performance in single to their average performance on that hero.
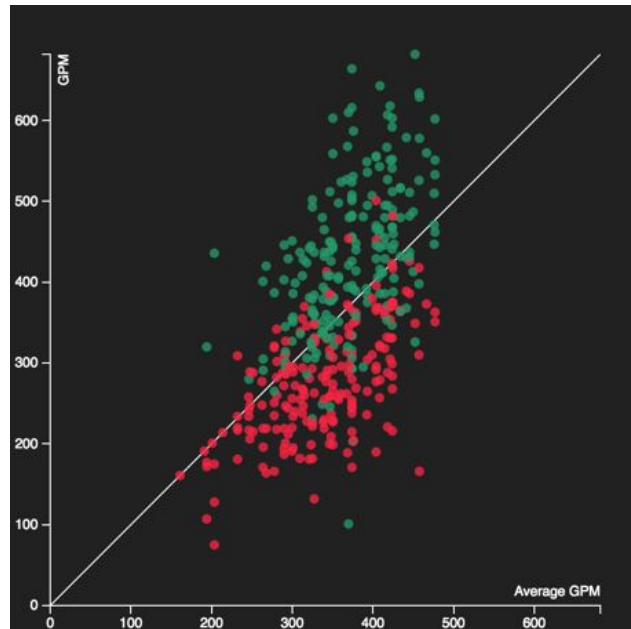
Figure 18. Final version
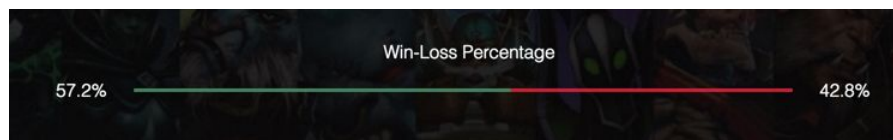
6.6 Win-loss bar and color choices

Figure 19. Win-Loss bar

We use red represent loss and green represent win in our visualisations. Even though green and red is not a good color combination. The Dota2 game uses green and red to show if a player won a match. Since most of the possible user of our sites are Dota players, we think it would be better if we use color combination that is familiar to them. Based on this consideration, we used blue to stand for intelligence heroes, red for strength heroes and green for agility heroes in the heroes play chart.

6.7 Match detail screen design.

There is not much hesitation before we made this final design. Almost every Dota2 related websites will use the same design of match detail.

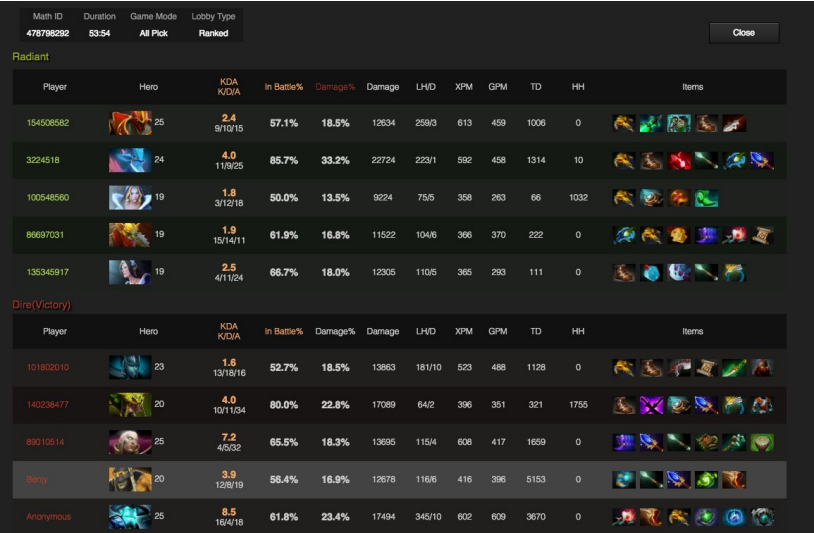Figure 20. Match detail screen in Dotabuff.

Figure 21. Match detail in our design

I think we have done a great replication job.

6.8 Records design

Initially we want to use a simple table to show player's records. But later we found it would be better if we can use hero's image as the background. We got this idea from Dotabuff.
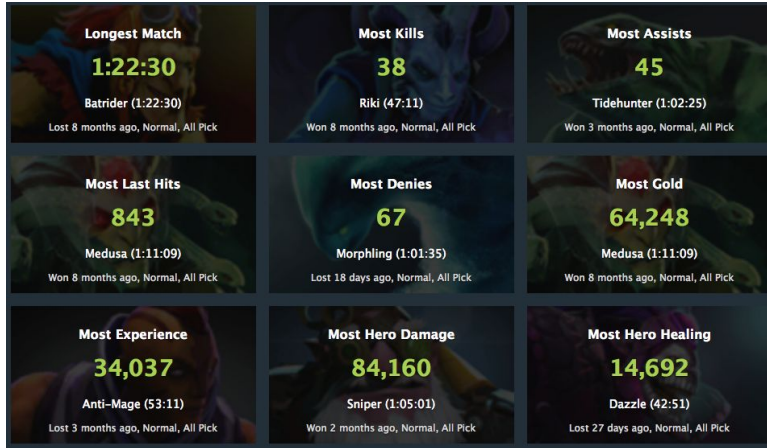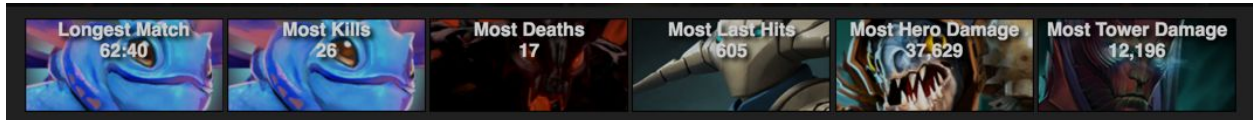
Figure 22. Dotabuff records page

Figure 23. Records visualisation
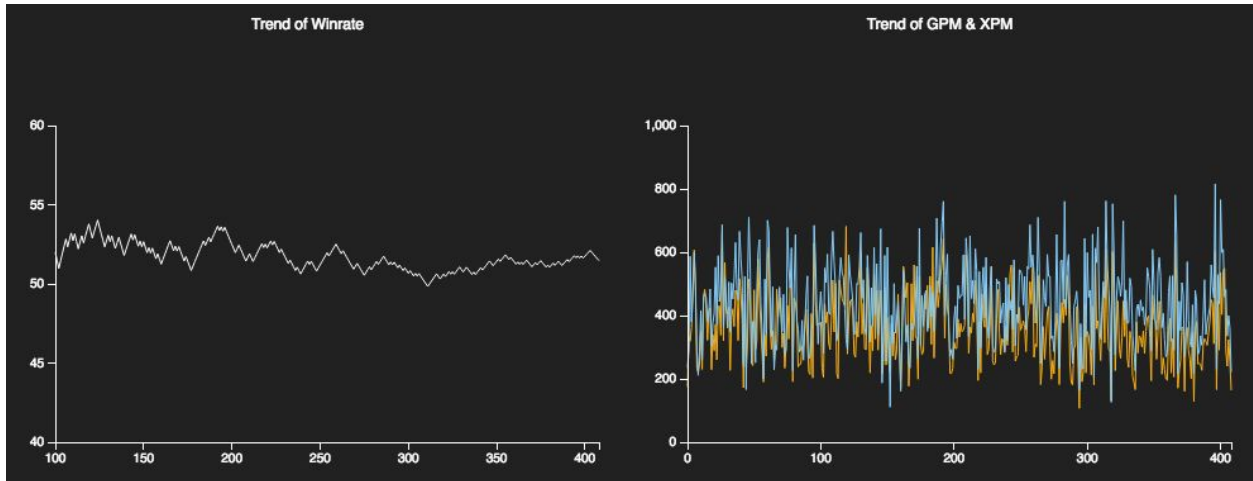
7. Implementation

7.1 Trend View

Figure 24. Trend View

Features:
1. Shown player's win rate trend if more than 100 games' data selected.
2. The trend of GPM/XPM chart has 3 states: XPM only, GPM only, and XPM/GPM together.

7.2 Heroes play chart
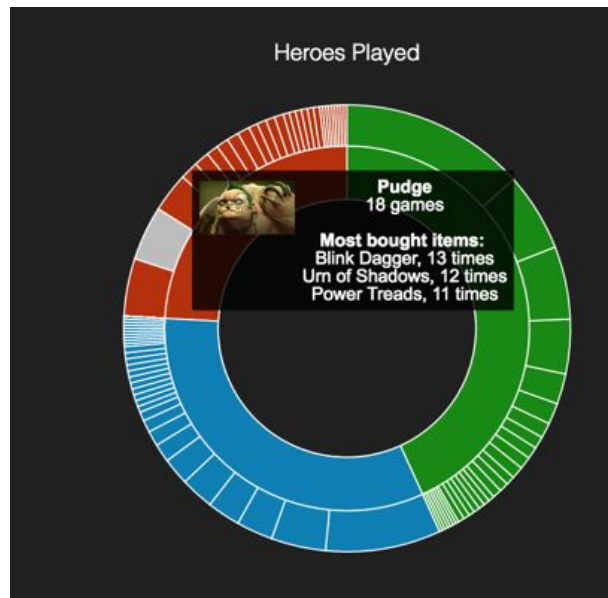
Figure 25. Heroes played chart

Features description:
1. Use blue, green and red to represent types of heros
2. Out most layer of the chart represents hero, inner layer represents the heroes in same type
3. Mouse hover on arcs will get a tooltip to show detail information.
4. Each arc can be clicked to zoom in, click center to zoom out.

7.3 Items purchased chart

Figure 26. Items purchased chart.

Features:
1. Height of bars represents the number of times the items being purchased in all games.
2. Color of bars represents the win rate of games that has bought this item.
3. Items can be sorted by name, number of times purchased, and cost.
4. Hover on bars will get a tooltip to show detail information.

7.4 GPM/XPM chart

Figure 27. GPM chart

Features:
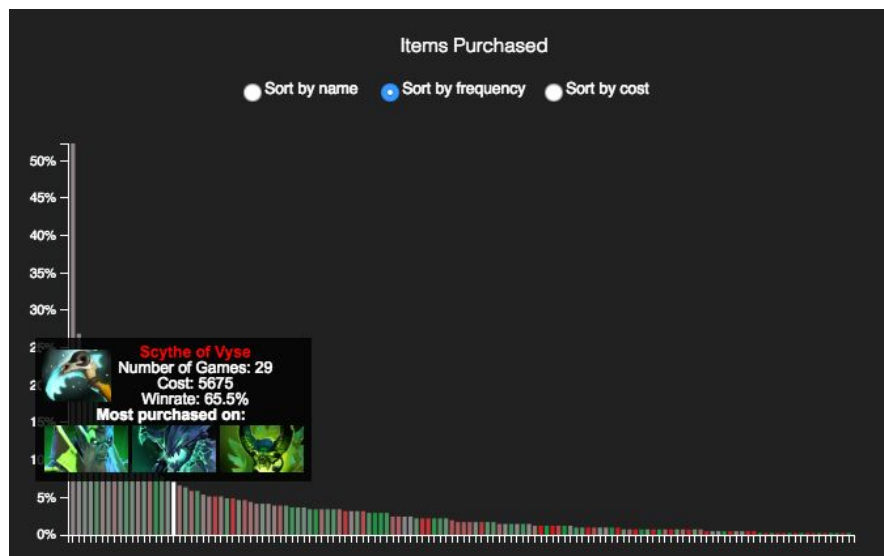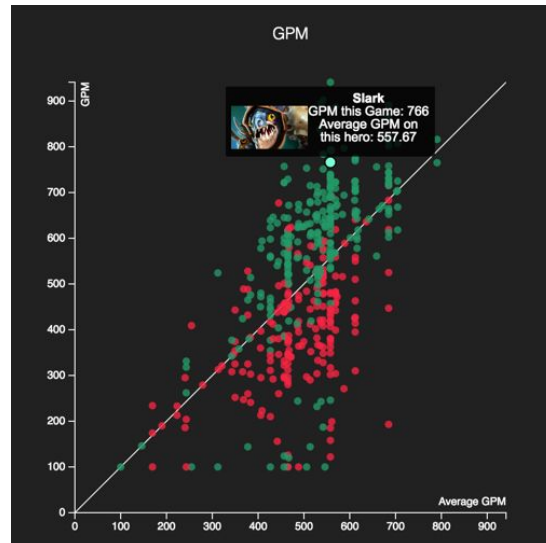1. Each dot represents one match. Red means the players lost in that match. Greens represents a victory.
2. Use average value as x-axis, user can compare his performance in a single game with his average performance. A dot located above the baseline means a better performance than his average level, below the baseline means a bad control of that game.
3. Hover on the dot will get detail information of the game.
4. Click the dot will call and show the match detail screen.
5. Dot in XPM graph and GPM graph are linked. Hover on dot in one of them will highlight dot represents the same match in the other chart.
6. Brush is allowed to enlarge a specific area.

7.5 Records view

Figure 28. Records

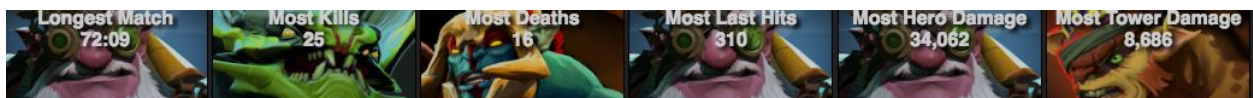Each records shows here and the records will update according to the data selected.

7.6 Filter

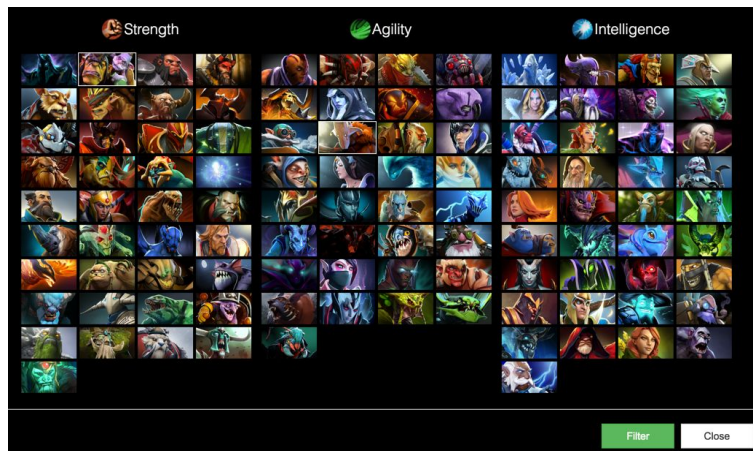There are 2 filters: Hero filter and Game Type filter

Figure 29. Hero filter

Feature:
1. Select the hero type(Strength, Agility, Intelligence) to select all heroes of that type.
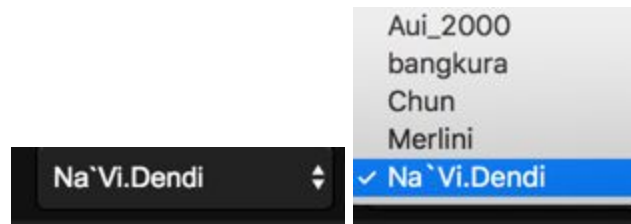2. Select a single hero to filter that hero only.

7.7 User selection

Figure 30. User(Dataset) selection dropdown

8. Evaluation

8.1 Learn about the data from our visualizations

Trend:
1. We can easily find the win rate trend of a player and find if the player have made a good strategy in his overall game play.
2. We can get player's XPM/GPM trend and see if the player have made a improvement in resource control.

Heros played:
1. We can easily find what kind of hero a player played the most and get his hero selection preference.
2. We can get a player's preference on item when we hover on the arc of that hero.

Items purchased:
1. We can get player's items selection preference.
2. A player can find which item has the highest performance cost ratio.
3. A player can find if an expensive item will result in a higher win rate.

XPM/GPM:
1. A user can compare his performance from game to game.
2. We can get what's the relationship between XPM and GPM.
3. We can find under what kind of circumstances a player can win when his performance is worse than his average level and in what kind of games a player will loss even though he outperformed his average level.

Win-Loss percentage:
   Get overall summary for this player's skill on this game.

Records:
1. Player will interested in their records in their match history.
2. A user can easily find the game he played the best and find a way to improve himself.

8.2 Answer to the question

How can I measure my performance in a single game?
A user can find the game he played in the GPM/XPM graph and compare it to others games that played the same hero. User can find if the GPM/XPM of that game greater than the average value. Also, user can filter the dataset and only see the games that he played this hero. The user will have a straightforward view on his performance on that hero.

How can I see what kind of heroes I played the most?
This can be easily found in the hero played graph. The arc takes the largest angle represents the hero type the user played the most.

How can I know what should I do to improve my skill of this game?
The user can find his win rate of a specific hero and know the items purchased when the user play that hero. If the win rate of that hero is relatively low, maybe the user should adjust his playstyle or learn how to play that hero from other players. In other words, a user can find which hero he should improve, which hero he should change playstyle. By getting such information from this site and practice more, the user's skill will improve significantly in the future.

How can I tell which hero I play best?
This can be find from the GPM/XPM graph. If most of games when he play that hero have a GPM/XPM larger than the average value, that hero is definitely the hero he has a deep understanding. In addition, the user can see which hero has the highest win rate, this also reflect if the user good at that hero.

8.3 Usage

All visualisation in our site will update according to the data selected.

8.4 How could us further improve

I think there are 2 ways we can improve in the future:
1. Make it a real-time application and built a database to get as much user's data as possible to compute some overall data such as the hero played the most by all players and the overall win rate for a given hero.
2. Built a system to judge a player's performance, produce a reasonable metric to measure the player's skill.